REPOSITIONING BRAZIL AS A GLOBAL HUB FOR **CLIMATE SOLUTIONS**

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I. Executive Summary

Why is Brazil pivotal to global climate action today?

Brazil holds strategic assets that make it highly relevant to global climate action. It's mostly renewable energy matrix, vast natural capital, advanced institutional framework, and innovative climate finance ecosystem are shaping solutions with impact potential far beyond its borders. For funders, Brazil is an opportunity to back climate models in Brazil that deliver measurable gains in mitigation and adaptation, help decarbonize global supply chains, and generate blueprints that other regions can replicate.

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Where can Brazil's comparative advantages contribute to global climate challenges?

Brazil's unique assets position it to help tackle some of the world's most pressing climate challenges. Its abundant renewable energy, biofuels expertise, and green hydrogen potential make it a strategic enabler to decarbonize industry and trade. The country's vast natural capital, advanced monitoring technology, and supportive regulatory frameworks open opportunities to develop credible, efficient carbon offsets. Brazil's advances in regenerative agriculture, bioinputs, and AgTech are transforming production while strengthening resilience for farmers. Meanwhile, its nature-based infrastructure and integrative climate and health systems offer replicable models for adaptation and urban resilience. These combined strengths position Brazil to meet its own climate goals while emerging as a strategic partner for global climate action.

Which climate solutions models stand out as globally relevant to deliver positive impact?

We are highlighting set of high-impact models selected for their relevance to global challenges, their potential to deliver climate and livelihood benefits while ensuring investability, alignment with Brazil's comparative advantages for climate action, and degree of innovation.

Climate Solution Model	What is it about?
Large-Scale Carbon Offset Mechanisms	Residual emissions from global industry and agriculture require offsetting solutions that are credible. Brazil's carbon-dense biomes, and advanced verification systems enable projects that deliver credible climate mitigation while improving rural livelihoods. By 2050, the country could offset ~30 billion tons of CO_2, nearly three-quarters of today's global energy emissions.
Bioinputs for Sustainable Agriculture	Chemical-intensive farming drives emissions and degrades soils. Bioinputs offer a low-carbon alternative, and Brazil already adopts them in a quarter of its cropland. Scaling adoption could only in Brazil avoid ~18 million tons of CO_2 yearly, equivalent to Uruguay's yearly emissions.
AgTech-enabled Regenerative Agriculture	Many producers see uncertain upsides and significant risk in attempting to transition to regenerative practices. AgTech enables data-driven deployment and verification, making these practices predictable and investable. With a diverse AgTech base, Brazil can help scale regenerative models globally and tap into a 23-gigaton CO_2 mitigation opportunity
Productive Models for Pastureland Recovery	Rising food demand is colliding with the urgent need to halt deforestation. There are over 100 million hectares of degraded pastures in Brazil that could be restored for productive use and prevent further deforestation of native forests. restoring only a third, could avoid ~4 gigatons of CO_2 emissions, equivalent to taking off the road 800 million cars each year.
Sustainable Mining of Transition Minerals	Global decarbonization hinges on critical minerals, yet supply remains concentrated and insufficient. Brazil holds significant reserves of transition minerals and rare earths, with untapped potential. By scaling sustainable mining models, the country can unlock these resources to diversify supply chains and accelerate the global energy transition.
Powershoring and Green Corridors	Hard-to-abate industries produce 40% of global emissions, most remain tied to fossil-heavy energy systems. Powershoring corridors enable industries to relocate production to regions with abundant clean and low-cost energy. Brazil, with one of the world's cleanest energy matrices and a diversified industrial complex, provide a pathway to decarbonize global supply chains
Green Hydrogen & Derivatives Export	Green hydrogen is critical to decarbonizing heavy industry but remains costly. Brazil's abundant low-cost renewable energy enables some of the world's lowest hydrogen production costs, supported by advances in production, processing, and distribution infrastructure
Next-Generation Biofuels	Transport sectors such as aviation, shipping, and trucking are under mounting regulatory pressure to decarbonize. With one of the world's most advanced biofuel industries, Brazil can supply next-generation fuels, like SAF, cellulosic ethanol, and green biodiesel from non-food feedstocks like macaúba or energy cane, cutting emissions while easing food security pressures
Urban and Coastal Nature-Based Resilience Systems	Despite strong potential, Nature Based Solutions (NbS) remain underutilized globally. Brazil is advancing urban–coastal NbS systems that link biodiversity restoration with flood and heat protection. Its diverse ecological assets and enabling finance frameworks make it the ideal place to prove NbS and demonstrate its investment potential
Integrated Climate & Health Adaptation Mechanisms	Climate change is driving new health emergencies, from heat stress to disease outbreaks, yet most countries remain reactive. Brazil's long experience confronting climate-related health risks and its integrated monitoring systems provide a platform to scale preventive, data-driven adaptation models with global relevance.

How is Brazil's climate finance ecosystem enabling these solutions to scale?

Brazil's climate finance ecosystem has become a laboratory for financial innovation that supports the development and scaling of climate solution models. It brings together all forms of capital; public, philanthropic, and private, to align incentives and close risk-return gaps that often constrain climate investment. New instruments are being tested and scaled, such as blended venture funds, de-risking facilities, and national investment platforms that are turning fragmented initiatives into structured, investable pipelines. For funders, this open ecosystem is ready for collaboration, offering proven vehicles and immediate opportunities for capital to accelerate climate impact.

In what ways can global funders and investors engage to unlock Brazil's potential?

Brazil has the models and financial ecosystem to deliver climate solutions. Global funders and collaborations can accelerate their deployment via a few primary pathways:

Invest in Brazil's ecosystem of early-stage ventures, growth-ready firms, and greenfield infrastructure (e.g., using catalytic grants, blended finance, and growth equity to unlock scale).

Integrate Brazilian solutions into global supply chains (e.g., by expanding sustainable feedstock, developing renewable-powered industrial hubs, and securing offtake agreements that stabilize demand).

Replicate distinctive Brazilian models abroad (e.g., by codifying policy and technical know-how, piloting globally relevant models in Brazil's diverse biomes, and scaling proven innovations internationally).

For funders and investors of all types, these pathways represent immediate opportunities to engage in solutions with global relevance. Realizing this potential requires collaboration with trusted local actors who bring the knowledge, networks, and access needed to translate capital into scalable climate impact.

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FOTO: JULIANA CARLA

II. About this Report

Context and objectives

This report was commissioned by the Instituto Clima e Sociedade (iCS) to showcase Brazil's potential to serve as a strategic partner in advancing global climate action. The country is already developing and demonstrating solutions with global relevance that can deliver both mitigation and adaptation outcomes. By highlighting these opportunities, the report seeks to deepen understanding among global actors of Brazil's climate potential, while also helping Brazilian stakeholders recognize how their initiatives contribute to global climate agendas.

Its objective is to equip funders, investors, and philanthropic partners with a clear view of where and how to engage: showcasing credible solution models, mapping investment and collaboration entry points, and outlining pathways for partnership with Brazil's growing climate ecosystem.

This is a strategic document designed to inform and inspire engagement. It does not aim to assess the technical feasibility of projects or provide an exhaustive mapping of initiatives. Instead, it offers a practical overview of opportunities where collaboration and capital can unlock Brazil's full contribution to climate progress.

Methodology

The analysis builds on an extensive review of over 100 secondary sources from public institutions, Non-Governmental Organization (NGO), multilateral organizations, and private-sector actors, complemented by expert interviews and continuous guidance from iCS program teams across areas such as land use, energy, and adaptation.

Climate solution models were selected according to four main criteria:

Alignment with global climate priorities – relevance to mitigation and adaptation challenges of international significance.

Brazil's comparative advantage – areas where the country's natural assets, policy environment, or innovation ecosystem offer distinctive potential to deliver climate outcomes.

Climate impact potential – capacity to deliver measurable emission reductions, resilience benefits, or co-benefits for livelihoods and ecosystems.

Innovation and scalability – demonstration of novel approaches, financial or technological models, or institutional arrangements that can be replicated or expanded.

III. Introduction:
Brazil's Untapped Potential in the Global Climate Transition

Global climate challenges demand solutions that deliver both measurable impact and investable opportunity. The urgency is no longer theoretical. Countries, communities, and markets are already grappling with disrupted food supplies, fragile infrastructure, volatile energy systems, and rising climate risks. What is needed now are scalable models that accelerate mitigation and build resilience and adaptation, while creating long-term economic value that justifies capital flows. Funders across regions are actively seeking such opportunities, where climate impact and tangible returns go hand in hand.

Brazil sits at the heart of this agenda, yet it is too often seen through a narrow lens. Its global importance is indisputable: the country holds the largest share of the Amazon and other carbon-rich biomes that regulate rainfall and weather patterns beyond South America. It is an agricultural powerhouse and the world's leading producer of soy, beef, coffee, and sugar, which are critical to global market stability and food security. It is also the most biodiverse and water-rich country on earth, with rivers and rainfall that power hydropower systems and sustain agriculture across the continent. Yet despite these assets, international narratives tend to highlight deforestation, droughts, biodiversity loss, and mounting pressures on water and food systems. These concerns are real, but they overshadow Brazil's pivotal role as a country uniquely positioned to drive solutions.

Less widely recognized is that Brazil's distinctive endowments are already generating solutions that can accelerate global climate action. Brazilian innovations are emerging with potential far beyond its borders. Brazil's clean energy base is driving low-carbon steel and cement production, while its biofuels leadership and advances in green hydrogen are opening new routes to reduce emissions across global supply chains. In parallel, Brazil is scaling regenerative agriculture and agricultural technology (AgTech) that boost productivity while cutting the sector's carbon footprint. Brazil is unlocking credible and cost-efficient voluntary carbon markets, combining strong governance and technology-enabled verification with vast restoration potential. At the same time, it is advancing bio-based innovations and transition minerals that provide the building blocks for a low-carbon economy. Finally, the country is testing and scaling nature-based infrastructure and health-linked technologies to mitigate climate shocks and safeguard livelihoods. These efforts are reinforced by enabling conditions: an advanced institutional framework, supportive policy environment, a dynamic innovation ecosystem, and a fast-moving climate finance sector that is addressing barriers and unlocking capital for climate solutions.

Global climate challenges demand solutions that deliver both **measurable impact and investable opportunity.**

FOTO: LUCAS LANDAU

IV. Brazil's Climate Solutions Portfolio for Global Impact

The global response to climate change remains constrained by complex challenges. Global trade and industry are still locked into fossil-fuel-based energy systems, while food production has been slow to adopt sustainable practices that can curb emissions without compromising food security. Climate risks are escalating faster than communities can adapt, and the energy transition faces persistent bottlenecks in scaling green technologies due to fragile and concentrated supply chains. At the same time, limited credibility and thin project pipelines continue to hinder the growth of carbon markets and climate finance more broadly.

Against this backdrop, Brazil is emerging as a source of tested and investable solutions. The models presented below demonstrate how innovation grounded in Brazil's assets can drive immediate climate action while advancing long-term shifts in how the world produces, consumes, and adapts.

1 **Large-Scale Carbon Offset Mechanisms –** Nature-based carbon credits at unmatched scale and integrity.

2 **Bioinputs for Sustainable Agriculture –** Green agricultural inputs to cut emissions and restore soils, reducing chemical dependency and boosting soil health.

3 **AgTech-enabled Regenerative Agriculture –** Leveraging technology to expand climate-smart production at scale.

4 **Productive Models for Pastureland Recovery -** Unlocking Brazil's next frontier of productivity while restoring forests and ecosystems.

5 **Sustainable Mining of Transition Minerals and Rare Earths for the Global Energy Shift –** Supplying essential minerals for the clean energy transition with socio-environmental safeguards.

6 **Powershoring and Green Corridors –** Converting renewable power into competitive green industrial production for global supply chains.

7 **Green Hydrogen & Derivatives Export Hubs –** Exporting clean energy supply from Brazil's renewable surplus.

8 **Next-Generation Biofuel Supply Chains –** Decarbonizing aviation and shipping through Brazil's biofuel leadership.

9 **Urban and Coastal Nature-Based Resilience Systems –** Protecting cities from climate extremes through Nature-based solutions.

10 **Integrated Climate & Health Adaptation Mechanisms–** Leveraging Brazil's leadership in managing tropical diseases to adapt health systems to climate risks.

1. Large-Scale Carbon Offset Mechanisms

Overview

Carbon offsets compensate for residual emissions by reducing or capturing carbon elsewhere. They are a critical tool to close the gap for sectors that cannot yet fully decarbonize. Their effectiveness depends on credible markets that channel finance toward verified, high-impact projects. Yet, today's markets remain fragmented, pipelines are small-scale, and funders are demanding greater transparency.[1] Brazil offers ideal conditions for high-impact, low-cost offsets, leveraging vast natural assets, advanced verification systems, and institutional frameworks that enable climate and social impact.

Global climate challenge

Residual emissions in agriculture and heavy industry will remain high, even as decarbonization advances. Hard-to-abate sectors like aviation, cement, steel, and petrochemicals will keep producing significant emissions, while industrial agriculture (e.g., livestock and fertilizers) adds further pressure.[2,3,4] Even under ambitious pathways, these emissions cannot be fully eliminated in the near term.[5] This reality is driving governments, corporates, and funders to seek offset mechanisms, fueling demand for large-scale solutions that deliver measurable impact.

Yet today's carbon markets are fragmented and face a credibility crisis. Carbon credits have been criticized for overstating benefits,[6] eroding trust among buyers and regulators.[7] This challenge is compounded by a shortage of large-scale, investable projects: most initiatives remain too small or fragmented to meet demand.[8] At the same time, funders are demanding more than just mitigation outcomes: offset projects are increasingly expected to deliver social impact, adding another layer of complexity to an already constrained pipeline.

The path forward is not to reinvent carbon markets, but to strengthen the project pipeline. The priority is to identify natural capital sources that enable large-scale initiatives, and to build the monitoring capabilities and institutional support needed to mobilize capital toward them. By activating these assets, offsets can deliver credible climate outcomes while meeting the growing need for carbon compensation.

Why Brazil?

Large-scale natural assets enabling low-cost sequestration. Brazil's ecosystems hold over 37 gigatons of soil organic carbon across the Amazon, Cerrado, Atlantic Forest, and Caatinga, in addition to immense aboveground biomass.[9] This makes it one of the largest natural carbon reservoirs worldwide, equivalent to seventy years of Brazil's current CO_2 emissions. Brazil also has over 100 million hectares of forests and degraded pasturelands with potential for restoration and sustainable land use.[10] The sheer size and ecological continuity of these landscapes allow offset projects to be structured at scale, lowering monitoring and transaction costs.

Advanced Monitoring, Reporting and Verification (MRV) technology ensuring offset transparency. Brazil also has technological capacity to addresses the credibility gap. Institutions such as the National Institute of Space Research (INPE) have dedicated infrastructure that monitors deforestation and soil change across all six biomes, allowing it to clearly define baselines and ensure compliance using data updated as frequently as every 15 days.

Funding models delivering co-benefits beyond financial returns. Brazilian projects are increasingly designed to deliver beyond mitigation alone. Restoration and sustainable land-use initiatives incorporate biodiversity protection, support to Indigenous and local communities, and sustainable production practices.[11] This integrated design responds to growing expectations for carbon projects to deliver beyond economic and climate value.

Supporting institutional and regulatory frameworks strengthening credibility. Brazil's regulatory progress stands out even against a backdrop of political complexity. The 2024 law creating the Brazilian Greenhouse Gas Emissions Trading System (SBCE) introduced a mandatory cap-and-trade regime, a centralized national emissions registry, and compulsory third-party verification of emissions data and credits.[12] Multi-actor governance frameworks bring together philanthropy, investors, and communities, clarifying land tenure and reinforcing credibility for international investors.

Impact Potential

Climate impact - By 2050, Brazil could generate 30 billion tons of CO_2 equivalent in carbon offset,[13] roughly equal to 75 percent of today's global energy emissions. Projections suggest that 75 percent of this abatement will come from REDD+, 23 percent from reforestation, and 2 percent from sustainable agriculture. Highly carbon-dense and efficient biomes underpin this potential: the Amazon averages about 50 tons of carbon per hectare in soils, the Cerrado and Atlantic Forest hold 30 to 40 tons of carbon per hectare.[14] Through avoided deforestation and conservation, Brazil can unlock large-scale, credible carbon abatement that few countries can rival while contributing to preserve the conservation of critical ecosystems.[15]

Market opportunity - Carbon credits in the Amazon were valued at US$1.3 billion in 2023 and could reach US$10.4 billion by 2030.[16] Additional untapped opportunities exist in other Brazilian biomes with urgent conservation and reforestation needs. Cost advantages further strengthen the case: Brazil can deliver CO_2 abatement at less than US$1 per ton, a fraction of the US$600–1,000 cost of engineered removals,[17] and about ten times cheaper than countries with high nature-based capture potential, like China or Mexico.[18] This positions Brazil to be the most cost-efficient provider of high-quality offsets globally.

Social impact - Brazil has pioneered carbon offset models that embed strong social safeguards and generate tangible benefits for rural and Indigenous communities. These projects improve smallholder incomes through crop diversification and sustainable production, create new opportunities in environmental services and ecotourism, strengthen land tenure, and finance local infrastructure for education, health and water systems.[19,20] For example, in Mato Grosso, the REM Early Movers program channeled resources directly to Indigenous communities via the Podáali Fund. By 2022, more than 380 communities had received funding for fire brigades, food security, cultural initiatives, and healthcare improvements.[21]

Brazil has advanced regulation to embed these co-benefits into new projects. CONAREDD+ and the 2025 National REDD+ Commission safeguards resolution now require benefit-sharing, Indigenous rights protections, communities' consultation and grievance mechanisms, reinforcing market integrity and inclusive development.

Maturity of the solution

Brazil's carbon offset sector is evolving from fragmented initiatives into a scalable, investable ecosystem. Over 120 REDD+ certified projects cover 3 million hectares of the Amazon, with 8 million more in development.[22,23] There is also growing demand for technology-driven restoration solutions, such as Mombak. Credit buyers like Microsoft, Google, and AXA demonstrate commercial traction, while institutional backing and the growing engagement of Brazil's financial system are helping turn carbon markets into a more mature and credible investment class.[24]

Building on this momentum, the next step is to diversify projects beyond the Amazon and reinforce the transparency mechanisms that underpin market confidence. To achieve this, the National Plan for the Recovery of Native Vegetation targets restoration across all biomes, including the Cerrado, Caatinga, and Atlantic Forest,[25] and emerging pipelines are being developed for blue carbon opportunities.[26] Equally important is verification transparency, supported by Brazil's INPE's infrastructure: PRODES (Monitoring Program for the Brazilian Amazon Forest by Satellite) and DETER (Real-Time Deforestation Detection System), platforms for real-time tracking of deforestation, while MapBiomas provides independent oversight of land-use change.[27]

Case Studies

1. PROFLORESTA+: INSTITUTIONAL INNOVATION FOR HIGH-INTEGRITY OFFSETS

ProFloresta+ is a large-scale reforestation and carbon credit initiative backed by a US$78 million investment. It aims to restore 50,000 hectares of degraded Amazon land with native species, combining ecosystem recovery with livelihoods and carbon offset generation, and applying safeguards that ensure biodiversity co-benefits. It is anchored by Petrobras, National Bank for Economic and Social Development (BNDES), the Nature Investment Lab, and iCS. The initiative was supported by Agroícone and Imaflora, which designed social safeguards, while Mattos Filho provided legal.

The program is expected to capture ~15 million tons of CO_2, equal to the annual emissions of nearly nine million gasoline-powered cars. This model combines future offtake commitments by Petrobras with concessional financing by BNDES, using the offtake as a guarantee. In addition, ProFloresta is projected to generate ~4,500 jobs, building on funder and investors' expectations to deliver tangible local benefits.[28]

The project shows how carbon markets can be structured to deliver credible climate impact while providing economic and social returns at scale. It offers a replicable model of how multi-actor partnerships can combine corporate demand, public financing, and community engagement to advance high-integrity offsets.

2. MOMBAK: TECHNOLOGY-ENABLED REFORESTATION AT SCALE

Mombak illustrates Brazil's ability to merge technology with restoration. Founded in 2021, the company applies AI-driven planting, drone monitoring, and machine learning to scale high-integrity removals. To date, Mombak has restored ~45,000 acres and planted over five million trees, with a target of eight million acres by 2026. Its backers include impact investors (e.g., AXA IM,[29] Bain Capital[30]), philanthropies (e.g., the Rockefeller Foundation[31]), development banks (e.g., BNDES[32]), and corporate buyers (e.g., Microsoft and Google[33]). It also partners with NGOs such as Conservation International to strengthen local impact and ecological integrity.[34]

Over its lifetime, Mombak expects to generate up to six million carbon credits, equivalent to offsetting the annual emissions of about 1.3 million passenger vehicles. These credits represent a market value between US$60-US$120 million. Beyond carbon, Mombak's work reconnects hydrological regimes, supports biodiversity recovery, and engages local communities directly in planting and monitoring activities.[35]

Mombak demonstrates how private ventures can combine technology, investment, and corporate demand to scale high-quality carbon removals. It also highlights a replicable model to strengthen MRV technology.

2. Bioinputs for Sustainable Agriculture

Overview

Bioinputs are agricultural products derived from microorganisms and plant compounds that can improve agricultural productivity while restoring soil health, water quality, and biodiversity. By reducing reliance on synthetic fertilizers and pesticides, they contribute to mitigating climate impact in agriculture through reduction of nitrous oxide emissions, enhancing soil carbon, and increasing resilience to climate stress.

In Brazil, bioinputs represent a major domestic and export opportunity within the country's US$19 billion agricultural input market,[36] as they can improve farmer margins due to their long-term cost advantage over conventional inputs.[37] Brazil has the potential to become a significant exporter of bioinputs, thanks to the country's strong Research and development (R&D) ecosystem, established adoption mechanisms, developed production capacity, and supportive financing landscape. These advantages allow Brazil to overcome production constraints seen in other markets, positioning it as a reliable source for global markets.

Global climate challenge

Agriculture accounts for approximately 30 percent of global emissions. Synthetic fertilizer use alone contributes about one-third of that total, driven largely by nitrous oxide released from soils.[38,39] Despite the impacts, global fertilizer demand continues to rise, locking farmers, including smallholders, into chemical-intensive systems that progressively degrade the very soils they depend on and undermine its long-term productivity.[40]

Bioinputs, such as biofertilizers, biostimulants, and biochar offer a sustainable alternative but still represent only 4 percent of the global agricultural input market.[41] Their limited adoption reflects systemic barriers: production constraints, shortages of raw materials, storage infrastructure gaps, higher upfront costs for farmers, and underinvestment in research and development.[42,43]

With the right enabling conditions such as clear standards, scaled production capacity, and catalytic investment in innovation and global distribution, bioinputs could substitute a meaningful share of synthetic agricultural inputs and contribute abate sector's emissions while strengthening resilience of global food systems. This becomes particularly relevant for small and medium sized farmers globally as they face higher costs and greater vulnerability to soil degradation from climate shocks.

Why Brazil?

R&D ecosystem coupled with unique biodiversity endowments enabling innovation. Brazil's research ecosystem combines exceptional biological resources with strong institutional capacity to overcome bioinput development barriers. Embrapa (Brazilian Agricultural Research Corporation), leading universities, and startups have advanced development of various biofertilizers, biochar, biopesticides, and biostimulants.[44,45] Examples include Embrapa's advances in microbial consortia for soybean nitrogen fixation and biochar applications for degraded soils. This combination of biodiversity access and research infrastructure allows Brazil to create bioinputs tailored to tropical farming conditions, solutions that address both domestic and global needs.

Established regulation frameworks to enable increased production. Supporting policy has enabled the expansion of production and adoption of bioinputs. The Bioinputs National Program, launched in 2020, aims to incentivize and strengthen the use of bioinputs in Brazil, driving collaboration among public, private, national, and international organizations.[46] More recently, Brazil enacted a bioinputs law in 2024 regulating its production, use, and commercialization and establishing clear institutional frameworks for the market.[47] By setting standards across the bioinputs value chain, Brazil positions itself as a regulatory and credibility reference for global bioinputs markets and as a standard in incentivizing regenerative agriculture at scale.

Established production capacity to support future growth. Brazil has built a strong industrial base for bioinputs, reducing import dependence and supply risks. Companies such as Biotrop, Vittia, Rizobacter, and Agrivalle produce biofertilizers, biopesticides, and biostimulants at scale.[48] In the 2023/24 crop year, bioinputs were used on approximately 26 percent of Brazil's planted area, six times more than the global average,[49] demonstrating growing adoption across farms of all sizes.

Innovative financing landscape supporting market development. Brazil's financial ecosystem is fueling bioinput expansion. Programs like the ABC+ Plan, the Brazil Climate and Ecological Transformation Investment Platform, and private funds such as the Growth Next-Generation Agriculture Fund channel capital of diverse types and blends to regenerative agriculture. Public credit lines under Plano Safra and BNDES complement these efforts by reducing borrowing costs and linking finance to technical assistance, critical for small and medium producers.[50,51,52,53,54,55,56,57] The Nature Investment Lab, a coalition led by the private sector and philanthropic actors, promotes collaboration and facilitates funding to bioinput initiatives.[58]

Impact Potential

Climate impact - Bioinputs can substantially reduce agricultural emissions by cutting reliance on synthetic fertilizers. Applying nitrogen-fixing bioinputs to just 10 percent of Brazil's 124 million hectares of grassland could avoid 5.7 million tons of CO_2e annually, equivalent to Uruguay's annual energy emissions.[59] In addition, by cutting reliance on synthetic fertilizers, bioinputs reduce nutrient runoff that pollutes hydric sources—improving soil health, limiting surface runoff and avoiding ecosystem harm.[60]

Market opportunity - Brazil's bioinputs market could surpass US$8.5 billion by 2035.[61] With over 1,000 registered products spanning biopesticides, biostimulants, and biofertilizers, and more than 170 active bioinputs producers. Brazil is not only growing its domestic demand but also positioning itself as a potential export hub.[62]

Social impact - - Smallholders face steep barriers to joining sustainable value chains, often remaining dependent on chemical inputs that degrade soils, pollute water, and erode yields over time.[63] Bioinputs can reverse this trend: seed inoculation trials in Brazil lifted grain yields by an average of 5.4 percent while improving soil health and resilience. Yet adoption remains uneven, ranging from 26 percent of planted areas in some regions to nearly 60 percent in others, revealing a major opportunity for expansion.[64] Efforts to close this gap are already being promoted through the 2024 Bioinputs law, creating incentives for smallholder and cooperative adoption, and through National Program for Strengthening Family Agriculture (PRONAF). BNDES is also expanding credit lines for sustainable inputs tied to technical assistance.

Maturity of the solution

Brazil's bioinputs sector has evolved from niche innovation to a robust and rapidly scaling market. In 2024, sales reached US$1.4 billion, growing 17 percent annually—four times the global average.[65] Adoption already spans 55 percent of soy, 27 percent of corn, 12 percent of sugarcane, and 6 percent of coffee, reflecting broad farmer uptake across key crops.[66] Investor confidence is also rising—for example, the US$569 million acquisition of Biotrop highlighted Brazil's competitive edge and the strong growth potential of its bioinputs sector.

Despite this momentum, bioinputs still represent only 7 percent of Brazil's US$19 billion agricultural input market,[67] leaving significant substitution potential. Many value chains remain underpenetrated, and on-farm production and export models are still at early development. Scaling will depend on addressing two key gaps: enabling exports and farmer inclusion. Divergent international safety and efficacy standards continue to limit exports, but the 2024 Bioinputs Law is strengthening registration and certification systems to enhance market credibility abroad.[68] Domestically, the National Bioinputs Program is expanding access to credit, technical assistance, and cooperative production, lowering adoption barriers for small and medium producers.[69]

Case Studies

1. FOLIO & TRAIVE: GROWTH NEXT GENERATION AGRICULTURE FUND (GAN)

In 2025, impact investment firm Folio and Brazilian agri-fintech Traive launched the US$50 million Growth Next Generation Agriculture Fund (GAN). The fund will invest in at least ten established bioinput SMEs supplying biological fertilizers and pesticides to major crops such as soybeans and corn. Its goal is to prove the commercial viability of bioinputs while accelerating Brazil's transition to regenerative agriculture.[70] GAN's investments are expected to transition 2 million hectares of farmland to regenerative practices, mitigating an estimated ~1.8–2.0 million tons of CO_2 e annually, equivalent to the yearly emissions of Paraguay.[71] An additional 2,312 tons of CO_2 equivalent per year will be avoided through reduced use of nitrogen-based fertilizers, equal to the emissions of over 500 cars.

The fund demonstrates how bioinputs can begin to capture part of Brazil's US$35 billion chemical fertilizer market, while targeting annual investor returns of 12–15 percent.[72] By expanding farmer access to sustainable inputs and training, it supports higher rural incomes, job creation, and broad adoption of regenerative practice.

2. BIOTROP: BIOINPUTS PRODUCTION AT SCALE

Biotrop is a Brazil-based biologicals producer focused on biocontrols, inoculants, and biostimulants. The company reports 50+ million liters of installed production capacity and a field force of 270+ agronomists; and over 900 employees. Biotrop has been expanding across Latin America and into the United States, including a new R&D center in Florida to support U.S. market entry. For 2023, estimated sales were of ~US$124 million.[73] In December 2023, Belgium-based Biobest Group acquired 85 percent of Biotrop at an enterprise value of ~$569 million Selling shareholders included Aqua Capital and GIC. This acquisition underscores investor confidence in Brazil's bioinputs market and sets valuation and scale benchmarks for funders and co-investors assessing Brazil-based platforms like Biotrop.

3. AgTech-enabled Regenerative Agriculture

Overview

Regenerative agriculture offers an alternative to industrial farming by restoring soils, protecting biodiversity, and increasing carbon storage through practices such as no-till farming, agroforestry, cover cropping, and crop rotation.[74] Yet adoption remains limited due to perceived risks, delayed results, and lack of localized data.

AgTech can close these gaps. Digital tools for soil monitoring, precision input use, and verification make regenerative practices measurable, predictable, and financially viable.[75] With deep agricultural expertise, a fast-growing AgTech ecosystem, robust R&D institutions, and strong public–private collaboration, Brazil is well-positioned to scale regenerative agriculture into a globally relevant solution for sustainable food production and climate mitigation.

Global climate challenge

Agriculture is a major driver of global emissions and environmental degradation, responsible for ~12 percent of global greenhouse gases.[76] At the same time, farming is highly vulnerable to climate change, with droughts, erosion, and biodiversity loss threatening food security and rural livelihoods. Without intervention, up to 90 percent of soils could be degraded by 2050.[77,78] Regenerative practices can reverse these trends by sequestering significant carbon emissions, reducing dependence on synthetic fertilizers and pesticides, improving water retention, and increasing biodiversity.

Yet barriers continue to limit wide adoption. Adopting regenerative agriculture demands confidence to change traditional methods, but limited evidence of localized benefits along with delayed results make the shift seem risky for farmers they often lack access to technical guidance that could support adoption. These constraints are acute for small and medium producers, who face tighter margins and higher transition risks.

AgTech can address many of these constraints by making regenerative outcomes visible, verifiable, and financially predictable. Digital tools allow farmers to monitor soil health, optimize input use, and quantify yield improvements—lowering long-term costs and attracting investment into sustainable farming models.

Why Brazil?

Robust AgTech ecosystem attracting fast-growing investment. Brazil hosts one of the largest AgTech ecosystems in the Global South, with over 1,900 startups in 2024 developing solutions for precision agriculture, soil monitoring, and climate smart related applications.[79] Investment is accelerating: In 2024, AgTech investments in Latin America grew 25 percent year-on-year, with Brazil's top five companies capturing 30 percent of total funding.[80]

Established agricultural R&D institutions enabling real-world AgTech deployment. Brazil has a strong research base in agricultural technologies, with Embrapa (the Brazilian Agricultural Research Corporation) at the forefront. Embrapa operates more than 40 research centers nationwide and has developed over 1,211 agricultural patented technologies.[81] Universities such as the University of São Paulo, along with regional research centers such as Agronomic Institute of Pernambuco (IPA), are also advancing digital solutions for regenerative practices. Together, they provide the technical foundation to pilot, adapt, and scale innovations diverse landscapes.

Public–private and international partnerships enabling AgTech expansion. Multiple private, public, and international initiatives are advancing AgTech adoption in Brazil. The Low-Carbon Agriculture (ABC) Plan promotes sustainable practices with a focus on digital tools.[82] The MAIS program, backed by the Interamerican Development Bank and NorFund, supports climate-smart technologies in regenerative farming.[83,84] Additionally, Brazil's PRONAF is supporting smallholders with credit for sustainable practices adoption, including AgTech.[85]

Extensive agricultural base coupled with regenerative know-how to create capacity to scale. Brazil already leads globally in regenerative implementation, with 100 million hectares under integrated crop–livestock–forestry systems and 33 million hectares managed through no-till farming.[86,87] A national survey of more than 2,000 farmers found that ~60 percent apply cover crops and biological controls.[88] This scale of adoption provides a strong base to further expand regenerative models across crops and geographies.

Impact Potential

Climate impact - Scaling regenerative agriculture through AgTech in Brazil could deliver transformative climate and environmental benefits. Enhanced soil-carbon sequestration could capture up to 23 gigatons of CO_2 by 2050, equivalent to nearly twice China's current annual emissions. Beyond mitigation, regenerative systems improve soil structure, reduce erosion, enhance water infiltration, and boost biodiversity, strengthening resilience against droughts, floods, and pests. When combined with digital verification and precision monitoring, these practices also reduce chemical runoffs and protect aquatic ecosystems, making them a cornerstone for both mitigation and adaptation.[89,90,91]

Market opportunity - Brazil's AgTech ecosystem offers growing investment potential. Total funding surpassed US$2.7 billion, with many startups still at seed stages.[92] Companies such as Genica, Agrolend, and Slinftec have attracted substantial backing and valuations near US$100 million, signaling strong prospects for scale.[93] For farmers, digital tools lower production costs, optimize input use, and support regenerative transitions.

Social impact - Transitioning to regenerative agriculture remains challenging for smallholders due to high upfront costs and uncertain returns. AgTech helps bridge this gap by making regenerative results visible and measurable, improving yields, water efficiency, and soil health. Digital platforms also strengthen decision-making on irrigation and crop diversification, helping farmers move beyond monocultures.

Brazil offers strong examples of how technology can accelerate this transition. The MAIS program, a state-led effort, introduced climate-smart tools to family farmers, demonstrating measurable improvements in productivity, water efficiency, and resilience to climate shocks.[94] Leading AgTech Agrosmart, working with reNature, has shown that digital monitoring can cut water usage by up to 60 percent while raising productivity by around 20 percent.[95] To advance AgTech as a driver of regenerative agriculture among smallholders, it is essential to strengthen critical enablers such as access to credit in already constrained rural regions where the state-led program for family farming (PRONAF) has not achieved significant coverage.[96]

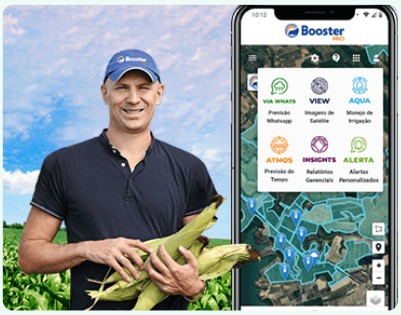
Maturity of the solution

Brazil's AgTech ecosystem for regenerative agriculture is expanding rapidly, supported by investor interest and public–private programs. From the 1,900 startups in the AgTech space, there are at least 350 in advancing smart climate technology linked to regenerative agriculture practices.[97] Investor interest, public programs, and established regenerative practices are now converging to drive adoption.[98,99]

The ecosystem's next challenge is mobilizing risk capital to test upstream innovations such as soil diagnostics, bio-based inputs, and adaptive modeling. Adoption remains uneven, and significant farmland still relies on conventional methods. Expanding investment, technical assistance, and data-sharing will be essential to move solutions beyond pilots toward large-scale implementation.[100]

Case Studies

1. AGROSMART: DIGITAL CLIMATE INTELLIGENCE DRIVING REGENERATIVE ADOPTION



Agrosmart blends low-cost sensors, satellite imagery, and machine learning into mobile guidance that helps smallholders adopt regenerative practices with less risk. The platform supports 100,000+ farmers across ~9 Latin American countries, and company-reported outcomes include up to 60 percent water savings and 20 percent lower energy use from smarter irrigation and climate-aware decisions. For co-ops, buyers, and lenders, Agrosmart provides traceability and MRV to verify cover crops, reduced tillage, and water-efficiency, linking small producers to premiums, concessional credit, or carbon programs. It has secured technical partnerships, such as one with Embrapa to work on automated pest diagnosis and climate forecasting.[101]

Agrosmart has expanded regionally by acquiring BoosterAgro, while attracting strategic investors including SP Ventures, Bradesco CVC, Positivo Tecnologia CVC, Swiss Pampa, and the coffee trader Sucafina.[102] Agrosmart illustrates how AgTech technology not only can drive adoption of regenerative practices for farmers of all sizes, but it can do so at a global scale, enabling its platform adoption in different region and climate contexts.

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2. RIZOMA AGRO: DIGITAL REGENERATIVE ORGANIC AGRICULTURE

Rizoma Agro is an initiative that combines digital farm management with regenerative practices across 1,200 hectares in Brazil, with a goal of scaling to 350,000 hectares by 2030. Its approach integrates crop rotation, silvopasture, and cover cropping, all supported by digital monitoring tools that track soil health and productivity. Rizoma Agro have enabled its farms to approximately double their water retention capacity and sequester up to 41 tons of carbon per hectare each year (in just the first year after shifting to regenerative production, levels of soil organic matter on two farms increased twofold). Production has shifted to even more regenerative systems that supply major food companies such as Nestlé and Unilever.[103]

Rizoma illustrates how technology-enabled regenerative models can move beyond pilots to reshape supply chains. For funders, it provides a replicable example of how digital verification, scalable regenerative methods, and corporate offtake can meet to reduce risks, increase adoption, and anchor long-term demand.

The ecosystem's next challenge is **mobilizing risk capital to test upstream innovations**

FOTO: GABRIELA SOUZA

4. Productive Models for Pastureland Recovery

Overview

Pastureland recovery converts degraded ranching areas into productive, sustainable systems through soil restoration, reforestation, and integrated crop–livestock–forestry (ILPF) practices. Despite its potential to boost food supply and protect ecosystems, it remains underused globally. Brazil holds the largest opportunity, with over 100 million hectares of degraded pastureland—an area nearly the size of Egypt. Transforming even a fraction of this stock into productive systems could meet growing food demand while reducing pressure to clear forests. ILPF offers one of the few proven pathways to simultaneously increase yields, cut emissions, restore biodiversity, and create investable rural economies.

Global climate challenge

The world faces a stark dilemma: rising food demand is colliding head-on with the urgent need to halt deforestation. Global food demand could rise by over 60%, while climate change may increase hunger risk by up to 30%.[104] More than 1.7 million hectares are deforested annually in the amazon,[105] with similar rates observed in Congo Basin,[106] and Southeast Asian forests.[107] This expansion of agriculture into frontier ecosystems is intensifying the climate crisis and eroding one of humanity's most vital natural buffers.

Despite the urgency, the world lacks a clear pathway to enable land for food production. Arable land is tightening, soil fertility is deteriorating, and inefficient land use is the global norm.[108] Weak governance and limited oversight allow deforestation to continue largely unchecked, while low-productivity cattle ranching and monocultures trap millions of hectares in underuse. Globally, this has created a system where agricultural growth is structurally linked to deforestation, locking in emissions, biodiversity loss, and fragile supply chains.

Recovering degraded pastureland offers a pathway to relieve deforestation pressure from food production. One of the most efficient and sustainable ways of doing so is through Integrated Crop-Livestock-Forestry (ILPF) systems that can deliver stacked benefits in the form of productivity gains, carbon sequestration, soil restoration, and biodiversity increase.[109] These models are increasingly investable, offering revenue diversification and resilience for producers while aligning with climate and conservation goals.

Why Brazil?

Vast stock of degraded land ready for restoration - Brazil holds more than 100 million hectares of degraded pastureland, of which close to half is considered suitable for immediate recovery into productive systems.[110] These areas can support multiple value chains: restoring cattle productivity on existing lands and expanding food and feed crops such as soy and maize without pushing into new forest areas. Unlocking this land base is one of the most direct ways to reconcile rising food demand with forest protection in Brazil.

Critical biomes benefiting from pastureland restoration - The recovery of degraded pastures is not only about production, but also a strategic shield for Brazil's most fragile ecosystems. By meeting agricultural demand within existing lands, Brazil can reduce the pressure that drives deforestation in the Amazon, Cerrado, and Pantanal. Preserving these biomes is essential for planetary climate stability as the Amazon alone stores more than 120 billion tons of carbon, while the Cerrado regulates rainfall patterns critical for regional agriculture.[111]

Proven scalable ILPF models championed by the private sector - Brazil is the world's leading developer and adopter of ILPF systems, with over 17 million hectares already under implementation.[112] These models combine crops, livestock, and trees in rotational systems that restore soil fertility, and sequester carbon in both biomass and soils. Beyond public research leadership from Embrapa, private agribusinesses are committing capital for pastureland recovery projects through the ILPF Promotion Network, building ILPF pipelines in partnership with communities and state actors.[113]

Policy frameworks enabling restoration at scale - Brazil's policy environment is evolving to actively promote restoration. Planaveg sets national targets and investment incentives to restore 12 million hectares of native vegetation, aligning with international restoration pledges.[114] In addition, the ABC+ (Low Carbon Agriculture) Plan offers concessional credit lines and technical support for ILPF adoption, while RenovaBio incentivizes emissions reduction through tradable carbon credits (CBIOs).

Impact Potential

Climate impact - Recovering degraded pastures reduces the need to expand into forests, the main driver of emissions in Brazil's land sector. Restoring just one third of Brazil's 100 million hectares of degraded pastureland were recovered, could prevent the loss of about 33 million hectares of forest, and avoid ~3.8 gigatons of CO_2 emissions,[115] nearly half of today's global annual emissions. ILPF systems further enhance this impact through tree integration and soil restoration, creating additional carbon sinks.[116] These practices also improve soil health, water retention, and hydrological stability, reinforcing long-term food system resilience.

Market opportunity - Recovering degraded pastures, could unlock US$60–141 billion in investment value, with returns of up to 54% depending on project type.[117] On the ground, these models raise revenues by combining crops, cattle, and forestry while lowering costs through healthier soils and efficient input use. Achieving the 12-million-hectare Planaveg target could yield an additional ~US$3.5 billion in productivity gains by 2030.[118] Beyond food production: restored pastures can also supply feedstocks for sustainable fuels, biomaterials, and other low-carbon industrial products.

Social impact - There is significant opportunity to benefit smallholders, who manage 73% of degraded pastureland.[119] Stacked benefits include income stabilization, higher productivity from healthier soils and improved water retention, and new opportunities to diversify production beyond cattle. ILPF systems generate revenue from crops, timber, and non-timber products (e.g., fruits, nuts, oils, and seeds) alongside markets for environmental services and rural tourism.[120] According to Instituto Escolhas, restoring 12 million hectares of degraded land — in line with Brazil's Planaveg target — could generate around US$100 billion in economic value and 2.5 million jobs over 20 years.[121]

A key enabler to scale ILPF systems, will be the implementation of Brazil's recently improved Forest Code, which organizes forestry activity, enables land tenure regularization, and creates compliance incentives for restoration. By 2024, 7 million rural properties had been registered, many from Indigenous communities.[122]

Maturity of the solution

Pastureland recovery is advancing in Brazil, with 17 million hectares already under ILPF adoption. Public and private support is growing: the Brazil Restoration & Bioeconomy Finance Coalition aims to mobilize US$10 billion for restoration and conservation by 2030, while BNDES and the Inter-American Development Bank are expanding blended finance initiatives for forest restoration. More than 70 large-scale forestry projects are in the pipeline, including 32 seeking over US$40 million in project finance.[123]

Key barriers persist. Smallholders often lack access to credit, technical assistance, and risk-sharing tools. Land tenure insecurity discourages investment, and illegal activities such as logging and mining undermine progress.[124] Enforcement remains uneven across Brazil's vast geography. Still, programs like ABC+ provide concessional finance, demonstration farms offer training, and monitoring tools such as DETER and the Rural Environmental Registry (CAR) increase transparency and compliance.[125,126]

Case Studies

1. INOCAS: MACAÚBA AGROFORESTRY FOR DEGRADED PASTURES

INOCAS is pioneering large-scale cultivation of the native macaúba palm on degraded pastures, integrating cattle and forestry into productive agroforestry systems. Since 2015, INOCAS has operated across 90 farms in three biomes, aiming to regenerate 50,000 hectares by 2030 in partnership with smallholders.[127]

In 2024, INOCAS signed a long-term agreement with BASF to supply macaúba kernel and pulp oil for personal-care and bio-based chemical markets. The partnership includes joint R&D and potential BASF equity investment, providing a clear commercial pathway for expansion. By turning degraded pasture into high-value agroforestry, INOCAS delivers climate, livelihood, and industrial benefits.

2. REVERTE PROGRAM: RESTORING DEGRADED PASTURELANDS IN THE CERRADO

Led by The Nature Conservancy (TNC) with Syngenta, Itaú BBA, and Embrapa, the Reverte Program restores degraded pasturelands in Brazil's Cerrado, one of the country's most pressured biomes. It combines credit lines, agronomic and technical assistance to help producers recover soils and transition to integrated soy–maize–livestock systems. In its first phase, Reverte mobilized US$33 million in loans to eight producers, covering 19 farms and 31,400 hectares of degraded pastures for recovery. Eligibility criteria include no deforestation after 2018, adoption of Embrapa's soil protocols, and strict environmental and labor compliance.[128]

By linking finance, technical support, and safeguards, Reverte demonstrates how public–private partnerships can scale restoration and advance deforestation-free supply chains.

5. Sustainable Mining of Transition Minerals for the Global Energy Shift

Overview

Transition minerals such as lithium, nickel, cobalt, copper, graphite, manganese, and rare earth elements underpin the technologies needed to expand renewable generation, scale energy storage, and electrify mobility and industry.[129]

Yet current supply projections fall short of demand, and extraction remains heavily concentrated in few countries, creating supply risks and price volatility. Brazil combines vast reserves, advanced mining capacity, and a supportive policy and financing environment that position it to become a reliable and sustainable producer, helping diversify global supply chains and accelerate the clean-energy transition.

Global climate challenge

The transition to net-zero will hinge on the availability of critical minerals. Meeting the Paris Agreement targets requires a fourfold increase in transition-mineral output for clean-energy technologies by 2040 compared to 2020.[130] However, new mining projects take an average of 16 years from discovery to production, meaning today's investments will only bear fruit well into the next decade.[131] This lag threatens to slow the scale-up of renewables, batteries, and electric mobility.[132]

Adding to the challenge, production and processing are highly concentrated. China holds nearly half of global rare-earth reserves, produces about 60 percent of supply, and controls over 90 percent of processing capacity.[133,134] By 2035, China is projected to refine more than 60 percent of lithium and cobalt and almost 80 percent of battery-grade graphite and rare-earth elements,[135] underscoring its critical role in the market. Recent disruptions—from social unrest in Myanmar, the world's third-largest rare-earth producer, to trade restrictions in other markets—have revealed the fragility of global supply chains.[136] Recycling could ease pressure but remains limited, with less than 15 percent of rare-earth materials recovered worldwide.[137]

The opportunity lies in expanding and diversifying production while embedding strong environmental and social safeguards. Sustainable mining models that minimize land disturbance, manage waste and water, and ensure community participation can both secure supply for the global energy transition and demonstrate that low-carbon minerals can also be responsibly produced.

Why Brazil?

Abundant reserves and favorable geology for efficient extraction. Brazil holds the world's second largest reserves of graphite and rare earths, the third largest of nickel, and the fourth largest of manganese.[138,139] Its geology allows multiple minerals, such as niobium, tin, and phosphate, to be extracted together, improving efficiency and lowering costs.[140] Rare-earth deposits in clay-rich soils are easier to process and contain both light and heavy elements critical for green technologies, reducing the environmental footprint of extraction.[141]

Established industrial capacity supporting large-scale operations. With more than 7,000 mining companies producing over 90 minerals, Brazil is already a top global supplier: 92 percent of the world's niobium, 17 percent of iron ore, and 23 percent of tantalum originate from its mines.[142,143,144,145] This infrastructure shortens development timelines and enables competitively priced production relative to other markets.

Clear policy direction and institutional coordination. The National Mining Plan 2030 and the Pro-Minerals Policy classify transition minerals as strategic, simplify licensing, and offer tax incentives and subsidies for sustainable production.[146,147] These policies establish clear institutional frameworks and governance processes in the sustainable mining sector. Internationally, Brazil participates in the UN Panel on Critical Energy Transition Minerals and the U.S.-led Minerals Security Partnership, aligning national priorities with emerging global standards. These frameworks provide predictability for investors and ensure adherence to environmental and labor norms.[148,149] Collectively, these initiatives establish a more predictable environment for investment and foster closer alignment between government and industry.

Growing financial backing for the sector. In 2025, BNDES and Finep launched a US$815 million fund for strategic-mineral projects through loans, equity, and non-reimbursable resources, attracting more than 150 proposals. Of this, US$178 million supports small and medium enterprises.[150,151,152] The Brazil Climate and Ecological Transformation Investment Platform also provide funding for projects involving strategic minerals.[153] International partners are also providing capital. Additional funding flows from the Brazil Climate and Ecological Transformation Investment Platform and international partners such as the U.S. Development Finance Corporation, which recently invested in Aclara's Carina rare-earth project.[154,155] Together these initiatives are consolidating investor confidence in Brazil as a diversified and trustworthy source of transition minerals.

Impact Potential

Climate impact - The energy sector accounts for about 75 percent of global greenhouse-gas emissions; meeting net-zero by 2050 will require six times more mineral inputs by 2040.[156] Brazil can meet part of this demand through lower-carbon extraction powered by its predominantly renewable grid. Companies like Viridis Mining and Serra Verde are adopting ionic-clay extraction methods that avoid blasting, cut water use, and reduce emissions.[157,158] States and municipalities can further amplify impact by channeling royalties into decarbonization projects, following the model of the Espírito Santo Fund, which invests part of its US$1.3 billion portfolio in climate initiatives supported by iCS.[159,160]

Market opportunity - As of 2024, Brazil's mining sector generated about US$46 billion in annual revenue, with transition minerals representing 16 percent of output—an increase of nearly 40 percent over 2023.[161] The country holds vast, underdeveloped reserves of rare earths, nickel, and niobium with exceptional market value: rare earth deposits are estimated at US$0.9–1.6 trillion, niobium around US$650 billion, and nickel approximately US$240 billion.[162]

Social impact - Sustainable mining can translate national resources into inclusive development. Projects such as Sigma Lithium and Serra Verde already employ and train local workers. Sigma reports that 70 percent of its staff come from the Jequitinhonha Valley—and invest in community infrastructure,[163] while Serra Verde's rare-earth project in Minaçu has committed to local hiring, skills training, and community investments.[164] In addition, Brazil's royalty system (CFEM) collected US$1.3 billion in 2023 for distribution to producing municipalities. Ensuring these funds support education, health, and infrastructure rather than recurrent expenditures will be key to converting mineral wealth into social progress. Transparent management, municipal capacity building, and participatory planning can maximize these benefits.[165]

Maturity of the solution

Lithium, nickel, and graphite already host several large-scale commercial operations—such as Sigma Lithium, Barro Alto, and Santa Cruz—while rare earths remain at an earlier stage, with Serra Verde as the only industrial-scale facility.[166,167] Across minerals, new investments and pilot projects are testing scalable, replicable models that point to the gradual consolidation of Brazil's critical-minerals ecosystem. Minas Gerais state alone expects cumulative lithium investments of about US$5 billion by 2030, up from more than US$1 billion in 2023, illustrating the catalytic role that subnational governments can play in accelerating sustainable mining.[168] High-grade, accessible deposits in Minas Gerais and Bahia state reduce material moved and energy consumed, keeping operating costs lower than in many peer countries. Viridis Mining & Minerals, for instance, projects the world's lowest-cost rare-earth operation in Brazil.[169,170,171]

Realizing this opportunity requires careful management of environmental and social risks. Mining can drive land degradation, waste generation, and water stress, and may trigger community and labor-related concerns. Brazil's regulatory framework and environmental-licensing system provide structured mechanisms to mitigate these impacts, establishing clear procedures for consultation, monitoring, and remediation.[172,173]

Case Studies

1. VIRIDIS MINING & MINERALS: THE COLOSSUS - RARE EARTH SUPPLY PROJECT

The Colossus Project, run by Viridis Mining & Minerals, is a key asset within Brazil's emerging rare earths portfolio. As of August 2025, it was estimated to contain one of the largest rare-earth-rich clay deposits in the world, totaling more than 200 million tons. This equates to ~528,000 tons of rare earths, which could support the production of 264,000 wind turbines.[174] The mine is projected to produce about 9,400 tons annually over a 40-year lifespan, backed by investment from BNDES's US$900 million critical-minerals fund.[175] High-grade, easily accessible clays allow low-cost extraction, and the company forecasts annual EBITDA of US$114 million with an internal rate of return near 40 percent.[176,177] The company projects this as the world's lowest-cost rare earth venture in Brazil.[178]

The Colossus Project highlights Brazil's potential to bring large-scale rare earth resources into sustained production at competitive costs. It underscores the opportunity to contribute with stable supply for wind and electric vehicle industries, while anchoring Brazil's role in diversifying global rare earth markets.

2. TEIÚ: VALUE ADDED SOLUTIONS FROM RARE EARTHS' MINING

Teiú Energia is an emerging startup developing transition minerals' byproducts into advanced energy-storage materials. The company converts niobium and vanadium mining residues—worth around US$16 per ton—into battery-grade materials valued up to US$20,000 per ton. Its proprietary process replaces graphite electrodes with nanostructured oxides derived from titanium and vanadium residues, improving performance while reducing waste and emissions.[179] Supported by SEBRAE's Catalisa ICT program and FAPESP's PIPE program, which funds early-stage technology development. The company has already secured funding for a project to verticalize Brazil's critical minerals chain and develop regional energy-storage solutions in the Northeast, where 75 percent of the country's renewable generation capacity is located.

Teiú Energia underscores Brazil's potential to turn resource waste into strategic value creation, strengthening its low-carbon industrial competitiveness.

6. Powershoring and Green Corridors

Overview

Powershoring refers to relocating energy-intensive production to countries with clean, reliable, and affordable energy, strong infrastructure, and access to key markets.[180] By developing renewable-based industrial clusters, powershoring can create green corridors—low-carbon trade and transport routes that link producers efficiently to global value chains. Despite its potential to drive deep decarbonization across hard-to-abate sectors, powershoring has not scaled globally.

Brazil combines a competitive industrial and logistics base with one of the world's cleanest electricity grids and rapidly expanding wind and solar capacity. These conditions allow the country to develop investable powershoring corridors[181] that supply low-carbon products to global markets and decarbonize energy-intensive sectors.

Global climate challenge

Hard-to-abate sectors such as steel, aluminum, and cement account for around 40 percent of global emissions, yet remain among the most difficult to decarbonize.[182] Electricity costs are rising as coal-dependent economies like China, India, and South Africa phase-out subsidies.[183,184,185] At the same time, carbon border taxes and stricter disclosure rules are beginning to penalize high-emission goods.[186,187,188,189] Recent supply chain disruptions have also exposed the vulnerability of existing industrial hubs, driving interest in more diversified and sustainable production bases.

Available options are limited. Carbon capture remains costly and unproven at scale.[190] While clean hydrogen and ammonia face infrastructure and transport constraint.[191] Most large industrial centers still rely on fossil-heavy power grids, restricting rapid emissions reduction. Producers are caught between rising compliance costs and the risk of losing market access—both of which erode competitiveness and slow global climate progress.[192]

Powershoring offers a practical alternative by relocating energy-intensive stages of production—such as smelting, refining, and chemical processing—to regions with abundant, low-cost renewable energy. Scaling these models and the green corridors that connect them will require targeted incentives, harmonized regulation, and coordinated investment in industrial and energy infrastructure.

Why Brazil?

Installed industrial capacity and low-carbon commodities to anchor global routes. Brazil hosts large-scale industries relevant for powershoring. It is the second largest iron ore exporter, holds the world's largest reserves of DRI-grade material, and ranks ninth in steel and aluminum production.[193,194] Major producers such as Vale, Gerdau, and Alcoa source most of their power from renewables.[195,196] Brazil is also a global leader in pulp and paper and has strong automotive, petrochemical, and aerospace cluster.[197,198,199] As the fourth largest maritime trading nation, its deep-sea ports sit close to industrial hubs that enable green export platforms.[200]

Renewable capacity expanding rapidly. Brazil's electricity mix is 88 percent renewable, compared with 32 percent globally and about 25 percent in China and India.[201,202,203] In 2024, the country added 11 gigawatts of new capacity, 91 percent from wind and solar. The Northeast region records wind capacity factors above 55 percent, among the world's highest, compared to 30–45 percent in Europe.[204,205,206,207] This combination of scale, reliability, and cost efficiency allows Brazil to deliver near-zero-carbon electricity competitive with fossil-based grids in Asia and Europe.

Export Processing Zones[208] turning green. Brazil's Export Processing Zones (EPZs) combine tax incentives with logistics infrastructure and now require all new projects to operate on renewable energy.[209] Zones in Ceará are already positioning to host green hydrogen,[210] while others attract data centers and manufacturing. As more EPZs are approved, Brazil is converting its clean energy advantage into globally competitive industrial platforms.

Impact Potential

Climate impact - Relocating energy-intensive industries to Brazil could deliver major emissions reductions. Brazilian steel production already emits ~35 percent less CO_2 than the global average (1.7 vs. 2.7 tons per ton of steel).[211] In aluminum, shifting just 1 million tons of production from coal-powered grids to Brazil would avoid 13 million tons of CO_2 annually—equivalent to emissions from over 2 million cars.[212,213] To put this in perspective, Brazil's total aluminum production in 2023 was 1.1 million tons, ~3 percent of Asia's 2020 output.[214]

Market opportunity - Brazil combines some of the world's lowest renewable electricity prices with targeted tax incentives and strong trade connectivity.[215,216,217] This creates a cost advantage for producers in hard-to-abate sectors like steel that could see cost reduction of up to 18% in powershoring locations. Opportunities extend beyond heavy industry: renewable-powered data centers and AI infrastructure are emerging, supported by abundant clean energy and international connectivity.[218]

Social impact - Renewable-powered industrial corridors can drive inclusive development by linking clean energy with job creation in regions of lower economic opportunity. The Northeast, which hosts over 70 percent of Brazil's installed wind capacity yet nearly half of its population in extreme poverty, illustrates this potential. Evidence from existing renewable projects shows increases in employment, local GDP, and formal labor participation.[219,220] Evidence from renewable projects shows contributions to job creation, regional GDP growth, and reductions in labor informality.[221] Expanding manufacturing around green Export Processing Zones can multiply these benefits through technical training, knowledge transfer, and new supply chains[222]. To ensure equitable outcomes, complementary policies such as education programs and incentives for local workforce development are essential to retain high-skilled jobs in the region.

Maturity of the solution

Powershoring in Brazil is shifting from concept to implementation, with maturity differing across sectors. Renewable-powered aluminum production has already proven commercially viable, while data centers, electric vehicle (EV) materials, steel, and wind-turbine manufacturing are beginning to relocate operations, signaling investor confidence. Meanwhile, other sectors where Brazil already has significant production capacity (e.g., petrochemicals) remain at a very early stage for powershoring.[223,224,225,226]

Scaling will depend on further investment in energy storage, transmission, and grid integration. These gaps are already being addressed, with new investments announced to strengthen grid capacity and better connect renewable generation to industrial hubs.[227] Battery energy storage systems, now advancing through Brazil's first capacity reserve auction, will play a central role in enabling continuous renewable supply for industrial clusters.

Case Studies

1. MERCEDES-BENZ DO BRASIL: SOLAR POWER FOR MANUFACTURING

Mercedes-Benz do Brasil partnered with Raízen Power to develop the Dunamis Solar Project in Rio Grande do Norte state—four photovoltaic plants spanning 410 hectares and 117 MW of capacity. Operational since January 2025, it supplies 100 percent of the electricity demand for factories in São Bernardo do Campo and Juiz de Fora municipalities. This directly advances Daimler Truck's global commitment to CO_2-neutral operations: the project will reduce emissions by up to 20,000 tons of CO_2 annually, equivalent to the annual electricity consumption of 48,000 Brazilian homes. Beyond its environmental impact, Dunamis has generated local benefits for Santana dos Matos, including public lighting for schools, provision of free electricity to municipal units, job creation, and professional training given in partnership with SENAI, the national institution of technical training.[228]

By offsetting all energy use of two major plants, Dunamis demonstrates how corporate–energy partnerships can decarbonize industry while generating tangible local benefits.

2. HYDRO REIN & PARTNERS VENTOS DE SÃO ZACARIAS: DECARBONIZING A GLOBAL ALUMINA SUPPLY CHAINEARTHS' MINING

The Ventos de São Zacarias project in Northeast Brazil directs 75 percent of its output to Hydro's Alunorte alumina refinery in Pará state, linking renewable generation directly to a global supply chain. The US$700 million project—financed by Hydro Rein, Macquarie Asset Management, Comerc Energia, and seven international banks—will generate 2 TWh of clean electricity and avoid ~2 million tons of CO_2 annually, equivalent to taking over 430,000 gasoline cars off the road. The project supported local communities by building a new center and water project for Quilombola families.[229]

The project shows that renewable energy can directly decarbonize energy-intensive exports at source. It also demonstrates how private-sector power purchase agreements (PPAs) can link renewable generation to industrial decarbonization in globally traded sectors, offering a model that can be scaled to other corridors.

7. Green Hydrogen & Derivatives Export Hubs

Overview

Green hydrogen is produced by splitting water into hydrogen and oxygen using renewable electricity through electrolysis, yielding zero or near-zero emissions. Its derivatives (e.g., green ammonia, methanol, and kerosene) are created from green hydrogen and serve as low-carbon substitutes for fossil-based chemicals and fuels.[230,231]

Green hydrogen production and use lacks scale. The main challenge is reconciling its high production costs with its strong abatement potential. Brazil's abundant and low-cost renewable energy corridors for export and distribution, supportive regulatory frameworks, and expanding financial support positions the country as a potential global leader in the production of green hydrogen and its derivatives.

Global climate challenge

Global hydrogen demand reached 94 million metric tons in 2023, yet less than 1 million tons came from low-emission sources,[232] and the current pace of green hydrogen deployment is far below what is needed to achieve a net-zero energy system.[233,234,235] Green hydrogen is essential to decarbonize hard-to-abate sectors (e.g., steel, cement, fertilizers, shipping, and heavy transport) that require high heat or cannot easily electrify. Its high energy density and purity also make it suitable for long-distance transport and the production of clean chemicals, supporting deep emissions cuts as industries face increasingly strict climate targets.[236]

The main challenge for green hydrogen is reconciling its high production costs with its strong abatement potential. For example, in chemical production, energy storage, and power generation, abatement costs are around US$100 per ton of CO_2 equivalent, making hydrogen competitive with other options. By contrast, uses such as boilers, heat pumps, and synthetic aviation fuels remain expensive, with costs ranging from US$500 to $900 per ton.[237] Costs depend on electrolyzer prices, renewable-electricity availability, policy incentives, and transport infrastructure. While electrolyzer prices are falling, few countries combine low-cost renewables, supportive regulation, and export logistics at scale that truly deliver a cost advantage.[238]

Green hydrogen can be a central driver of industrial and transport decarbonization if produced where costs are low and demand is secure. The opportunity lies in scaling regions that combine abundant renewable resources with industrial demand and export capacity, enabling them to function as global supply hubs. In such settings, green hydrogen can move from costly pilots to a competitive commodity that accelerates mitigation outcomes.

Why Brazil?

Abundant, low-cost renewable energy enabling efficient production. Brazil offers ideal conditions to ensure low-cost green hydrogen production.[239] Brazil generates over 88 percent of its electricity from renewables—one of the cleanest grids globally, and its hydroelectric reservoirs provide built-in storage, which can stabilize output and lowering variability in hydrogen production costs.[240] These factors enable an average levelized costs of hydrogen[241] estimated at ~US$1.2 per kilogram in Brazil,[242] compared to ~US$2.0 in the United Kingdom, and ~US$3.0 in South Korea and Japan.[243]

Industrial and export infrastructure connecting production to global markets. Hydrogen development is concentrated along industrial corridors that link renewable hubs to deep-water ports. Planned projects in Ceará, Bahia, and Pernambuco states connect solar and wind zones to maritime export terminals, reducing logistics costs. At least ten coastal sites already host renewable facilities suitable for hydrogen production, and Export Processing Zones (EPZs) offer fiscal and logistical incentives for trade.[244,245,246]

Supportive policy and regulatory frameworks. The 2024 Low-Carbon Hydrogen Law established Brazil's first comprehensive framework for the sector, defining rules, governance, and sustainability standards. Complementing this, the Special Incentive Regime for Low-Carbon Hydrogen (Rehidro) provides US$3.4 billion in federal tax credits between 2028 and 2032, nearly half the annual fiscal support for the entire power sector.[247,248,249]

Expanding investment enhancing the green hydrogen sector. National and international financing is beginning to flow into Brazil's green hydrogen sector. The government has secured US$5 million from Spain to build a pilot plant, while multilateral partners such as the World Bank, CIF, and other MDBs are financing electrolyzer clusters and port infrastructure in Ceará and Bahia states.[250,251,252,253] Corporate commitments from Casa dos Ventos, Fortescue, Stegra, and Vale—many through Brazil's Climate and Ecological Transformation Investment Platform—illustrate growing private-sector confidence.

Impact Potential

Climate impact - Green hydrogen could abate up to 80 gigatons of CO_2 by 2050—more than twice today's annual global industrial emissions. Brazil could capture approximately 10 percent of this market, equivalent to 8 gigatons of cumulative abatement by 2050.[254,255] In steelmaking, shifting to hydrogen-based processes can cut emissions by up to 98 percent[256,257] with significant potential to replicate this impact in sectors such as chemicals, fertilizers, shipping, and heavy transport that cannot rely on direct electrification.[258] Green hydrogen can also optimize Brazil's renewable grid by converting excess wind and solar output into storable energy, reducing curtailment and enhancing grid stability.[259]

Market opportunity - Brazil is positioned to capture annual revenues of US$15–20 billion by 2040, with US$10–12 billion from domestic demand (notably trucking, steel, and fertilizers) and US$4–6 billion from exports. Projected production capacity ranges from 8 to 31 million tons per year by 2050, depending on investment and policy strength.[260,261] For comparison, current global production of low-emission hydrogen is only ~250,000 metric tons.[262]

Social impact - - Green hydrogen can drive inclusive regional development, particularly in Brazil's Northeast where renewable potential is concentrated. Large-scale projects generate thousands of construction and operational jobs and stimulate local value chains through manufacturing, logistics, and infrastructure upgrades. Initiatives like Pecém Verde plan to create roughly 1,400 direct and indirect jobs with gender-inclusive hiring targets. Investments in desalination, water pipelines, and port modernization can extend community benefits beyond industrial use.[263,264]

However, these projects also carry risks: fisheries and coastal livelihoods may face disruption, ammonia handling entails health hazards, and enclave-type hubs could limit local spillovers. Developers are beginning to embed safeguards through consultation processes, grievance mechanisms, water-use guarantees, and strict safety standards to ensure social and environmental co-benefits.[265,266]

Maturity of the solution

Momentum around green hydrogen in Brazil is growing, with more than 111 pilot and demonstration projects under way across 15 states. Together, they explore the technical and commercial viability of green hydrogen, e-methane, and green steel, representing a pipeline of US ~$82 billion.[267] Supportive government measures, including the 2024 Low-Carbon Hydrogen Law and targeted tax incentives,[268] are reinforcing this trend and creating greater certainty for investors. The strong pipeline and favorable policies point to two main opportunities: scale early domestic proven pilots and models into large-scale production and continue to support the build-out of export infrastructure that connects Brazil's green hydrogen to global markets.[269]

Despite this progress, some gaps remain. Brazil still needs to scale electrolysis capacity, prove market viability beyond pilots, mobilize investment for large-scale production, and establish systematic export capacity for hydrogen and its derivatives.

Case Studies

1. WORLD BANK, FORTESCUE, CASA DOS VENTOS, TOTAL ENERGIES: CEARÁ GREEN HYDROGEN HUB IN INDUSTRIAL AND PORT COMPLEX OF PECÉM

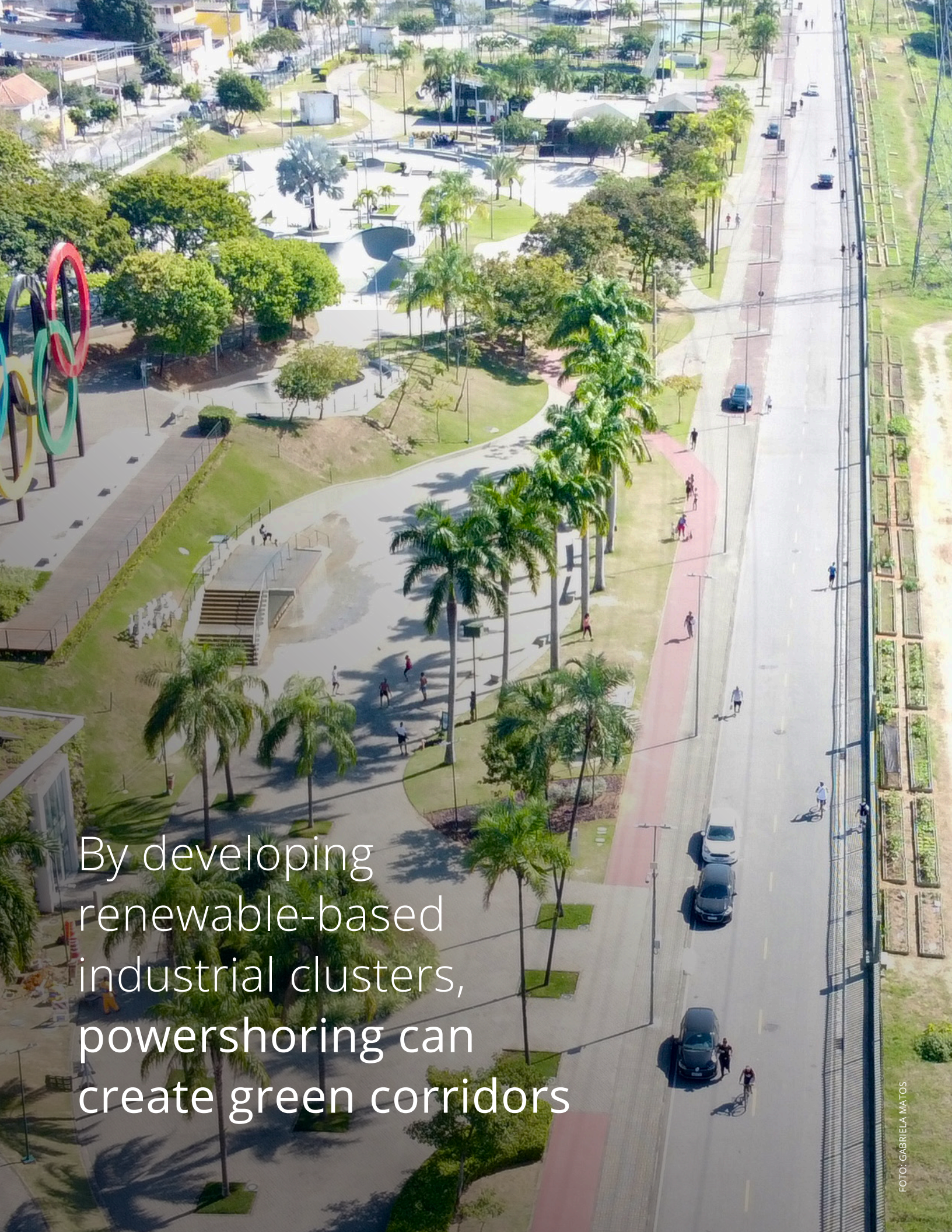
The Ceará Green Hydrogen Hub is a globally oriented, multi-phase export hub anchored by public-private partners. The hub will use electrolysis powered by renewable energy to produce clean hydrogen and convert it into ammonia for targeted European export. Nearly 40 memorandums of understanding with national and international companies have been signed, and the first pilot is set to start in 2025. The project represents US$7 billion in investment across two phases: 500 megawatts of electrolyzers in Phase I to produce 400,000 tons of ammonia annually, expanding to 2 gigawatts and 1.6 million tons by 2030. It is expected to generate about 1,500 construction jobs and 200 permanent positions, supplying up to 15 percent of the EU's projected green-ammonia imports by 2030. It is expected to create ~1,500 jobs during construction and 200 permanent jobs during operations, while contributing up to 15 percent of the EU's projected ammonia imports by 2030.[270]

The Ceará hub illustrates how Brazil can link abundant renewable resources with global clean energy demand. It also demonstrates the potential of public–private partnerships to anchor large-scale hydrogen exports.

2. UNIGEL: GREEN HYDROGEN PLANT IN BAHIA

The Unigel Green Hydrogen Plant, located in the Camaçari Industrial Complex in Bahia state, an industrial pioneer, focused first on domestic market demonstration and gradual scale-up. Commissioned in 2023 with an investment of US$120 million, it includes 60 megawatts of electrolyzers and produces 10,000 tons of hydrogen and 60,000 tons of green ammonia per year. Expansion plans aim to quadruple capacity to 40,000 tons of hydrogen, enough to power more than 20,000 electric cars annually. The project has generated over 500 jobs and strengthened local industrial capacity, demonstrating the viability of early domestic production for both local and export markets.[271]

The Unigel facility signals Brazil's entry into large-scale green hydrogen production, demonstrating how early industrial hubs can strengthen domestic value chains and anchor the development of broader hydrogen market.



By developing renewable-based industrial clusters, **powershoring can create green corridors**

FOTO: GABRIELA MATOS

8. Next Generation Biofuels Supply Chains

Overview

Biofuels are essential for near-term decarbonization in aviation, shipping, and long-haul trucking where electrification is limited. A new wave of next-generation fuels is emerging, including cellulosic ethanol, sustainable aviation fuel (SAF), and advanced biodiesel produced from non-crop feedstocks that avoid land-use change and deliver lower lifecycle emissions than conventional biofuels.

Scaling these fuels requires expanded capacity, reliable feedstock streams, and lower technology costs. Brazil is well positioned to lead, combining an established biofuel industrial base, deep technical expertise, and a large domestic market that can accelerate adoption and enable global deployment.

Global climate challenge

Heavy transport (aviation, shipping, and long-haul trucking) account for more than 10 percent of global greenhouse gas emissions and remain among the hardest sectors to decarbonize.[272] Unlike passenger vehicles, they have few near-term alternatives: batteries are not viable for long-distance freight, hydrogen lacks the infrastructure and cost profile needed for mass adoption in global transport.[273] Liquid fuels will therefore remain indispensable in the near term, making the transition to low-carbon alternatives urgent.

Regulatory pressure is mounting. International frameworks in aviation and shipping, together with regional mandates, are pushing companies to integrate sustainable fuels.[274,275] Conventional biofuels will continue to contribute, but their impact is capped by feedstock competition with food, land-use concerns, and blend limits.[276,277] Advanced biofuels are earlier in their scale-up, with technical and cost constraints that limit current supply.[278] This creates a transitional gap between what regulation demands and what the fuel mix can supply.

Closing this gap requires scaling next-generation fuels and their feedstock procurement. Pathways include SAF from residues, macaúba and waste oils, cellulosic ethanol from agricultural byproducts, advanced biodiesel from used cooking oils, and e-fuels produced with green hydrogen. As technologies mature and costs decline, these fuels can become both scalable and cost competitive. Unlocking this opportunity will require expanding production, mobilizing feedstocks, and providing long-term policies and offtake certainty.

Why Brazil?

Installed low-carbon industrial capacity ready to scale. Brazil is a top global producer with more than 43 billion liters of annual ethanol and biodiesel capacity, ranking second in ethanol and third in biodiesel.[279] This scale sits on an electricity mix that is about 88 percent renewable, lowering processing emissions and creating a ready platform for next-gen deployment.[280]

Abundant and reliable feedstock value chains for biofuel production. Brazil has already developed robust value chains for ethanol and biodiesel and is now scaling toward next-generation biofuels. Its agro-industrial system provides one of the world's most cost-efficient feedstock bases: sugarcane supplies more than half of global ethanol feedstock, soy dominates biodiesel inputs.[281,282] Residues such as bagasse and straw add significant feedstock potential for advanced fuels. Macaúba, a promising oilseed with higher oil yields than soy, cultivation and refining for renewable diesel and SustainableAviation Fuel (SAF) is attracting multi-billion-dollar investment.[283] The Nature Investment Lab, co-led by iCS, is catalyzing financing for macaúba enterprises such as INOCAS and S.Oleum.[284]

R&D ecosystem to accelerate product development. Brazil's early biofuel adoption laid the foundation for its current advantages in advanced biofuels. Institutions like Embrapa, universities, and industry players have led innovations including cellulosic ethanol, alcohol-to-jet SAF, and biorefinery co-products.[285]

Clear incentives and market signals driving advanced biofuels. The national SAF roadmap sets long-term targets aligned with the mandates from the International Civil Aviation Organization (ICAO),[286] while RenovaBio's program incentivizes producers by issuing tradable carbon credits (CBIOs) tied to lifecycle GHG reduction, rewarding lower-carbon fuels.[287] Additionally, the Brazil Climate and Ecological Transformation Investment Platform provides funding to sustainable fuels projects.[288] On the investment side, major international investors and established Brazilian players have deployed in 2025 more than US$3 Billion targeting new biorefineries and production capacity of SAF, Renewable Diesel and ethanol.[289]

Impact Potential

Climate impact - Sugarcane ethanol in Brazil already reduces 40 to 60 percent of CO_2 versus gasoline, while conventional biodiesel reduces about 75 percent versus petrodiesel.[290] At current volumes, this avoids 42 to 64 million tons of CO_2 annually,[291] roughly 10 to 15 percent of Brazil's energy-sector emissions. Yet deeper decarbonization will depend on advanced biofuels. Converting only 10 percent of today's ethanol and biodiesel output into cellulosic ethanol and advanced biodiesel could avoid an additional 8 million tons of CO_2 annually.[292] In addition, if 1percent of jet fuel global consumption was to be substituted with SAF it would further cut ~6.5 million tons of CO_2 annually.[293,294] Crucially, these fuels are made from residues, waste oils, and other non-crop feedstocks, reducing lifecycle emissions while easing pressure on land use.

Market opportunity - Brazil is the world's second-largest biofuel market, worth about US$40 billion per year at current volumes and prices.[295] Most production is absorbed domestically, supported by high gasoline prices and a fleet where more than 70 percent of vehicles are flex-fuel, creating reliable offtake.[296] Exports to the United States, Europe, and Asia are expanding, with strong prospects for SAF under EU mandates.[297] Crucially, Brazil is structurally more cost-competitive than the United States, especially in ethanol[298] and positions the country's industrial base for cost-efficient production of advanced biofuels.

Social impact - The sector supports more than 800,000 jobs and drives livelihoods, rural energy security, and innovation.[299] Through the Social Fuel Seal, biodiesel producers that source 10 to 30 percent of feedstock from family farmers receive tax credits and stable demand while providing technical assistance. More than 50,000 families benefit today, and a new decree requiring at least 50 percent of biodiesel feedstock from family farming could expand participation by 120 percent.[300] Biofuels also reduce diesel import dependence and can support rural electrification in underserved regions.[301,302] At the same time, biofuels generate spillover effects on Brazil's innovation ecosystem as universities and R&D centers are advancing major research efforts.

Maturity of the solution

Advanced biofuels are at an early stage but are gaining momentum on top of a consolidated conventional market. In 2025, BNDES approved US$165 million for Raízen's new cellulosic ethanol plant, and Mubadala Capital announced plans to invest about US$13 billion over the next decade in renewable diesel and SAF.[303] The Nature Investment Lab, a coalition with diverse stakeholders, facilitated part of its US$73 million initiative in macaúba projects for renewable diesel and aviation biofuels.[304]

Brazil is tackling the main barriers to advanced biofuels head-on. To broaden sustainable non-crop feedstocks, partnerships are advancing lignocellulosic materials and scaling the use of sugarcane bagasse.[305] To lower production costs and expand biorefinery capacity, the national development bank BNDES is financing next-gen biofuel production initiatives.[306] In addition, to secure reliable offtake, the Future Fuel Law establishes clear blending mandates for SAF, renewable diesel, and other next-generation fuels.[307]

Case Studies

1. MUBADALA CAPITAL: BIOFUELS HUBS FOR SAF PRODUCTION

Mubadala Capital, the Abu Dhabi investment company, controls Acelen, which acquired Petrobras' Mataripe refinery in Bahia. In 2024, Acelen announced a US$13.5 billion program to retrofit the site into a biofuels hub producing renewable diesel and SAF. The plan foresees five production modules, each requiring approximately US$2.7 billion, scaling the refinery conversion and capacity to attain a production of 2 billion liters of biofuels per year.[308] This ranks among the largest single SAF commitments worldwide and shows how repurposed infrastructure, large-scale capital, and abundant feedstocks can anchor export-oriented growth. This is one of the largest single SAF commitments worldwide and marks Brazil as a key hub for aviation decarbonization.

2. RAÍZEN: CELLULOSIC ETHANOL PROGRAM

Raízen, a joint venture between Shell and Cosan, is the world's largest sugarcane ethanol producer and a catalyst for next-gen biofuels in Brazil. In 2025, Raízen secured US$ 165 million in concessional financing from BNDES to expand its cellulosic ethanol (E2G) program, including a new Andradina plant producing 82 million liters annually from sugarcane residues.[309] Raízen is also partnering with Embraer on SAF for aerospace, with Volkswagen on new ethanol-based formulas for low-carbon mobility, and with Vertoro on waste-based biofuels, including lignin blends for dual-fuel maritime engines.[310]

9. Urban and Coastal Nature-Based Resilience Systems

Overview

Urban–coastal nature-based solutions (NbS) harness ecosystems such as mangroves, wetlands, and floodplains to protect cities from flooding, heat, and erosion. They deliver scalable adaptation while restoring biodiversity and capturing carbon, offering more sustainable long-term protection than traditional grey infrastructure. Yet global adoption remains limited, constrained by the lack of large-scale models, gaps in valuing natural capital, and few proven business cases or policy incentives.

Brazil is emerging as a living laboratory to overcome these barriers. It combines a wide portfolio of natural assets with the right enabling environment: strong institutional support, advanced climate-risk intelligence, and a growing investment ecosystem. These conditions enable scalable and bankable NbS that can be replicated globally.

Global climate challenge

By 2050, around 16 percent of the world's population will face severe heat stress and 8 percent will be exposed to coastal flooding[311,312,313] placing a quarter of the world's population at risk. Cities such as Jakarta,[314] Tokyo,[315] and New Delhi[316] already illustrate the risks, experiencing floods and heatwaves that disrupt livelihoods and economies. The economic toll is rising: heat exposure could cause annual productivity losses of US$2.4 trillion by 2035, while urban flood damages are expected to triple to US$64 billion by 2050.[317,318]

Conventional grey infrastructure like seawalls, drainage systems, and cooling technologies can offer protection but is costly, inflexible, and difficult to maintain in rapidly growing cities.[319] Relocation is extremely complex while insurance markets are often underdeveloped and even unwilling to cover climate risks.[320,321] Nature-based solutions are often more cost-effective, yet they remain perceived as risky ventures.[322] Valuation models for natural capital are limited, few business models have been demonstrated at scale, and policy frameworks have yet to create consistent incentives for investment.[323]

The opportunity lies in identifying and scaling natural assets with high adaptive potential—particularly mangroves, wetlands, and riparian systems—and demonstrating that they can generate measurable climate, social, and economic value. Well-designed NbS not only protect vulnerable populations but also support biodiversity, enhance health, and create new green-economy opportunities.

Why Brazil?

Extensive natural capital with underused potential. Brazil hosts about 9 percent of the world's mangroves, second globally, but its marine and coastal ecosystems receive among the lowest levels of adaptation funding across its biomes.[324,325] This represents a major untapped opportunity: recent analyses estimate that Brazil's NbS potential could reach 1 gigaton of CO_2 equivalent per year, comparable to the annual emissions of the global aviation sector.[326,327]

Strong institutional and financial infrastructure to scale NbS. Brazil has built a favorable environment for NbS expansion. National programs such as Projeto Orla promote integrated coastal management, while the Plano Clima (National Adaptation Plan) institutionalizes NbS across municipal and coastal sectors. Financially, BNDES channels capital through its Ecological Transformation Investment Platform and Eco Invest auction, both including urban–coastal NbS in their eligibility criteria. Private capital is also entering the space: funds from Pátria and BTG Pactual are developing dedicated NbS portfolios, signaling growing confidence in natural assets as viable investments.[328,329,330]

Replicable urban-development models already in practice. Cities such as Recife, Curitiba, and Belém are piloting NbS including mangrove restoration, rain gardens, and floodplain parks.[331,332] Programs like CITinova and municipal initiatives in Sobral and Campo Grande are developing interconnected green–blue corridors and biofiltration systems that combine water management, biodiversity restoration, and public-space design, creating models that can be replicated elsewhere.[333]

Advanced intelligence systems supporting climate-risk monitoring. Brazil's real-time, data-driven platforms enhance the design and scalability of NbS. The AdaptaBrasil platform consolidates climate-impact indicators across all 5,570 municipalities, while the National Center for Monitoring and Early Warning of Natural Disasters provides real-time alerts for floods and landslides. Together, they enable transparent, evidence-based planning for nature-based resilience.[334,335]

Impact Potential

Climate impact - Estimates account that Brazil could hold up to 10% of world's NbS mitigation potential. In Urban–coastal NbS in Brazil can deliver substantial mitigation and adaptation benefits. The country's NbS potential of up to 1 gigaton of CO_2 equivalent annually, about 2.7 percent of global emissions, places it among the top global contributors to nature-based mitigation.[336,337,338] Restoring mangroves alone could sequester around 17 million tons of CO_2 annually, while also buffering storm surges and preventing coastal erosion. Globally, NbS interventions have shown biodiversity gains of up to 67 percent, underscoring their dual role in restoring ecosystems and stabilizing the climate.[339,340,341]

Market opportunity - Investment momentum in nature-based solutions is accelerating, driven by the search for scalable adaptation assets and reliable climate returns. Multiple Brazilian and regional funds are now structuring NbS-focused portfolios targeting double-digit returns, including vehicles managed by Capital for Climate, Pátria, and BTG Pactual.[342.343,344] Mangrove restoration alone represents a US$9 billion opportunity in Brazil's voluntary carbon market, while complementary activities—such as aquaculture, sustainable fisheries, and ecotourism—add further revenue potential.[345,346].Beyond mangroves, NbS as underpin about 70 percent of Brazil's voluntary carbon-credit supply, linking environmental performance to market-based income streams.

Social impact - NbS deliver protection and livelihood benefits for vulnerable communities. Mangroves provide an estimated US$65 billion annually in flood protection worldwide. With 9 percent of global mangrove coverage, Brazil's ecosystems could account for up to US$6 billion of avoided damages each year.[347,348] These benefits disproportionately protect low-income populations most exposed to flooding and heat. Restoration activities also generate jobs—approximately 0.42 jobs per hectare—while supporting traditional livelihoods such as artisanal fisheries and ecotourism.

Maturity of the solution

Brazil's NbS ecosystem is maturing rapidly, combining a growing pool of investable projects with an expanding pipeline of city-level pilots. According to Capital for Climate, by September 2025 the country had at least US$2.5 billion in investable NbS opportunities across 36 transactions—up from roughly US$1 billion in 2024.[349] Ticket sizes are also increasing, moving from small concessional grants to blended-finance structures exceeding US$300 million, reflecting stronger institutional capacity and investor trust.

Specific for NbS in coastal areas, many Brazilian cities are advancing projects for climate adaptation. The NbS Accelerator recorded more than 84 of these initiatives, such as the Socio-Environmental Recovery in High-Risk Areas in municipality of Santos, the Green and Blue Infrastructure System in municipality of Sobral, and riparian restoration through the Águas do Capivara Program in municipality of Camaçari.[350] Municipal governments are also leading; with projects like Recife's 30 km green–blue corridor, which will benefit nearly half a million residents while reducing flooding and urban heat. Together, these efforts signal that Brazil is beginning to establish proof of concept at scale.

Despite this progress, most initiatives are still siloed, without a systematic approach to planning or financing. Recent national frameworks,[351] financial platforms[352] and climate risk intelligence systems[353] provide an initial foundation for a more integrated pathway.

Case Studies

1. CITINOVA PROGRAMS: NATURE-BASED URBAN PLANNING

The CITinova Program, led by the Ministry of Science, Technology and Innovation (MCTI) with UNEP, FUNBIO, and city partners, integrates nature-based and low-emission solutions into urban planning. CITinova I (2018–2022), funded by US$23 million from GEF-6 and US$195 million in co-financing, piloted NbS in Recife and Brasília, including river-filter gardens, green–blue corridors, and peri-urban agroforestry systems. These pilots improved drainage, restored vegetation, and enhanced local biodiversity.

CITinova II (2023–2027), supported by US$12.5 million from GEF-7 and US$185 million in co-financing, is scaling to Belém, Florianópolis, and Greater Teresina. It aims to restore 27,000 hectares of landscapes and improve management of 18,000 hectares of protected areas, benefiting 2.4 million people and targeting annual mitigation of 106,000 tons of CO_2 e through mangrove and wetland restoration and low-carbon urban design.[354]

2. SPVS, FUNBIO, BNDES, PETROBRAS: COMMUNITY-BASED MANGROVE ECOSYSTEM RESTORATION

Led by SPVS in the Grande Reserva Mata Atlântica (northern of Paraná state), this community-level program invested US$8.6 million to restore mangrove-connected landscapes and strengthen the management of the local fishery. The projec t has planted 28,000 native seedlings[355] and covered 316 hectares for mangrove restoration,[356] equivalent to ~50,000 tons of CO_2 equivalent[357] or the emissions of ~10,000 passenger cars. In addition, it has strengthened monitoring of the local caranguejo-uçá (Ucides cordatus) fishery, linking conservation with the livelihoods of artisanal crab fishers.

By linking conservation, climate mitigation, and livelihoods, this model demonstrates how community-led NbS can deliver measurable ecological and social dividends.

10. Integrated Climate & Health Adaptation Mechanisms

Overview

Integrated climate–health systems connect climate risk monitoring (heat, floods, air quality) with health surveillance (disease incidence, hospital admissions, emergency care) and response protocols. They allow governments to anticipate threats, mobilize resources, and reduce preventable illness and deaths during climate extremes. Despite their central role in adaptation, most countries lack mature systems due to fragmented data infrastructure, limited financing, and weak incentives for prevention.

Brazil offers a distinctive opportunity to advance these mechanisms. The country has decades of experience confronting climate-related health risks, from tropical diseases to floods and drought. It is investing in surveillance platforms such as Notifiable Diseases Information System (SINAN), VigiÁgua, and AdaptaBrasil that link climate and health data, and is advancing policy frameworks like the National Policy on Health and Climate Change. These foundations allow for testing and scaling integrated models that improve resilience and reduce inequities in health outcomes.

Global climate challenge

Climate change is multiplying health risks. Rising temperatures and shifting weather patterns are expanding infectious diseases, worsening non-communicable disease burdens linked to air pollution and heat stress, and increasing physical and mental trauma during extreme events. The World Health Organization projects an additional 250,000 deaths per year by the 2030s from climate-related impacts. Moreover, 58 percent of known human pathogenic diseases are being aggravated by climatic hazards.[358,359] Nearly 10 percent of the planet's land area is now classified as "high" or "very high" risk of disease outbreaks due to climate extremes.[360] Low- and middle-income countries require at least US$11 billion annually this decade to adapt health systems.[361]

Despite growing awareness, health systems remain poorly equipped to adapt to climate pressures. Climate and health agencies often operate in silos, with few integrated data systems to anticipate risk.[362] Financing is limited, with fewer than one in ten countries securing adequate funds for climate–health strategies.[363] Insurance mechanisms are underdeveloped and poorly tailored to climate-related health shocks.[364] Fragmented planning and weak collaboration make most responses reactive rather than preventive.

Scaling integrated climate and health mechanisms can close this gap. Brazil offers a distinctive opportunity: decades of experience with climate-sensitive diseases, a health system that has confronted extreme climate events across diverse biomes, and advanced surveillance platforms like SINAN and AdaptaBrasil that integrate health and climate data; Brazil offers models on anticipation, coordinated response, and climate resilience.

Why Brazil?

Public health system with deep experience managing climate-related health risks. Brazil's diverse geography has exposed it to a wide spectrum of climate-sensitive health challenges, and the country has repeatedly turned this exposure into systematic responses with measurable gains. On tropical diseases, Brazil reduced death risks from neglected tropical diseases by 46 percent between 1990 and 2016,[365] and the World Health Organization (WHO) recognized the country for eliminating lymphatic filariasis.[366,367] Beyond infectious diseases, Brazil has pioneered responses to other climate-driven health risks, monitoring of forest-fire smoke has been used to anticipate respiratory and cardiovascular hospital admissions; it has demonstrated capacity to deploy rapid responses to extreme climate events that include dispatch of mobile health units with psychosocial care teams; and Brazil's Psychosocial Care Network (RAPS) is leveraged to address trauma and mental-health recovery.[368,369]

Established surveillance systems for real-time monitoring. Brazil has invested in data systems that connect climate signals with health outcomes. The National Information System for Notifiable Diseases (SINAN) requires reporting of infectious, vector-borne, and environmental diseases across all municipalities, with severe cases flagged within 24 hours.[370] The AdaptaBrasil platform adds municipal-scale climate-risk indicators, including health, to map hotspots where climate hazards and health risks converge.[371] Complementary programs extend this surveillance to specific risks: Vigidesastres tracks disaster-related health outcomes, while Vigiagua monitors drinking-water quality and contamination across states and municipalities.[372]

Research partnerships driving innovation. Universities and public institutes collaborate with international partners to develop predictive models and decision tools. Fiocruz, the Federal University of Minas Gerais, and the Bill & Melinda Gates Foundation are advancing disease scenario modeling and estimation of health impacts from climate.[373,374] The National Institute for Space Research (INPE) operates the Queimadas and CATT-BRAMS systems to forecast wildfire smoke which serves to design health concerning responses.[375] The National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN) applies predictive analytics to floods and landslides.[376] The Rio de Janeiro Health Secretariat has piloted protocols to anticipate heat wave impacts.[377]


FOTO: JULIANA CARLA

Institutional frameworks to adapt health policy for climate resilience. Brazil formalized a National Policy on Health and Climate Change in 2008.[378] It guides integration of climate adaptation across the health sector, from surveillance of climate-sensitive diseases and heat risk to infrastructure planning and workforce training. More recently, the Belém Health Action Plan positioned health at the center of climate governance. The plan commits Brazil and neighboring Amazon countries to coordinated action on climate-health priorities such as infectious disease surveillance, air-quality monitoring, and protection of vulnerable populations.[379]

Impact Potential

Climate impact - Integrated monitoring of health risks and climate hazards can also yield co-benefits for ecosystem conservation. Brazil faces acute biodiversity risks from extreme heat and drought, with projections of up to 40 percent species loss in some biomes under worsening scenarios. Platforms like AdaptaBrasil generate municipal indicators that link hazards, disease risk, and population exposure.[380] These data streams can signal ecosystem stress early: spikes in fire, smoke, or vector-borne disease often correlate with forest degradation, water scarcity, and biodiversity decline.[381]

Market opportunity - The economic case is visible in avoided losses. Extreme floods in Rio Grande do Sul in 2024 caused more than US$4 billion in damages and reconstruction costs, while dengue outbreaks can cost up to US$900 million to the Brazilian economy.[382,383] Two recent public programs show investable returns from climate–health systems: the Paraná Public Sector Modernization and Innovation of Service Delivery Project (US$6 billion) achieved a 24 percent IRR, and the Piauí Health and Social Protection Development Systems Project (US$62 million) achieved a 25 percent IRR.[384] In both cases, value creation came from avoided economic losses tied to health impacts, measurable improvements in service delivery, and direct gains in local productivity.

Social impact - Brazil is acutely vulnerable to the health impacts of climate change. Heatwaves, floods, and vector-borne epidemics are already causing avoidable deaths, injuries, and strain on the public health system.[385] The country has important foundations in place, a universal health system and a National Policy for Climate Change Adaptation—but the scale of risk now demands far greater investment. In 2023 alone, more than 60 million Brazilians were exposed to extreme heat, hundreds of thousands were displaced by floods, and dengue surged to 12.5 million reported cases over five years.[386,387] These figures highlight the urgency of strengthening prevention, preparedness, and response capacity nationwide.

Yet the burden is not evenly shared. Low-income families, Indigenous peoples, and rural communities are disproportionately exposed while having the least access to resilient infrastructure and care.[388] Closing this gap requires an explicit climate equity lens, ensuring that adaptation investments prioritize those most at risk.

Maturity of the solution

Brazil's climate–health adaptation architecture is advancing. The National Policy on Health and Climate Change and the Belém Health Action Plan embed resilience in public health priorities. SINAN, VigiÁgua, and Vigidesastres connect disease, water, and disaster surveillance, while AdaptaBrasil and National Center for Natural Disaster Monitoring and Alerts (CEMADEN) extend real-time climate intelligence. Municipal innovation is evident in Rio de Janeiro's extreme-heat protocol and Recife's integrated disaster health response, both early evidence that resilience models can be implemented at city scale.

Yet most financing is largely reactive, tied to disaster recovery rather than prevention, and private capital rarely links explicitly to health outcomes. To achieve maturity, Brazil must expand piloting across diverse geographies, integrate predictive analytics and AI into frontline services, and close its adaptation financing gap. These steps would move the system from promising foundations to scalable, equity-centered models that can be replicated.

Case Studies

1. ADAPTABRASIL: CLIMATE ADAPTATION SURVEILLANCE SYSTEMS ENABLING HEALTH RISKS MONITORING

AdaptaBrasil is Brazil's national platform for climate-risk surveillance, covering all 5,570 municipalities. Developed by the Ministry of Science, Technology and Innovation with INPE, Fiocruz, and other partners, it integrates data on climate hazards, disease risks, and population exposure into municipal indicators. The health module tracks vulnerabilities to diseases such as dengue or leptospirosis, supporting prevention and response strategies. Policymakers already use the platform to anticipate outbreaks and prioritize high-risk populations.

Enabled by the National Adaptation Plan and federal investments in climate intelligence, AdaptaBrasil is informing policy and finance decisions. In 2025, Minas Gerais state created a R$400 million credit line with preferential terms for municipalities classified as high risk by the platform.[389] The AdaptaCidades program used its data to select 260 municipalities for local adaptation plans, and PRO-AdaptaVias is integrating its indicators into infrastructure planning. With further investment, AdaptaBrasil could evolve from risk mapping to proactive disease control and cross-sector mitigation of adaptation risks, providing a replicable model globally.[390]

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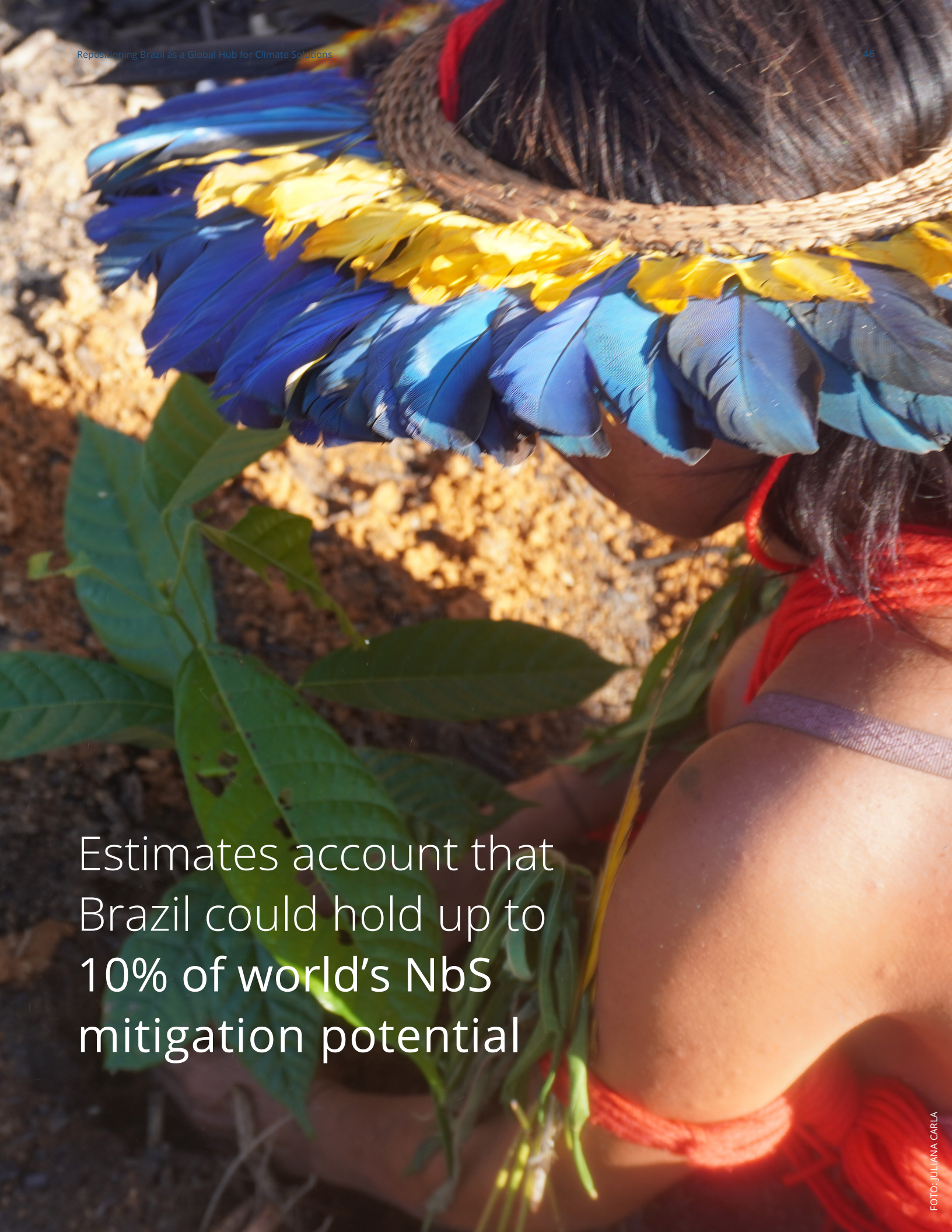
2. BRAZIL'S INTEGRATED CLIMATE X HEALTH RISK MANAGEMENT: SINAN + VIGIÁGUA + VIGIDESASTRES + CEMADEN

Brazil has built an interconnected architecture for monitoring climate-related health risks. SINAN, the national disease notification system, requires reporting of conditions like severe dengue within 24 hours. VigiÁgua tracks drinking-water safety, while VigiDesastres monitors health outcomes during disasters. These systems are complemented by CEMADEN, the national center for monitoring floods and landslides, which supplies real-time alerts used by health authorities to anticipate emergencies.

These mechanisms are grounded in long-term investment in health surveillance and policies such as the Belém Health Action Plan, which placed climate resilience on the public health agenda. In 2024, CEMADEN issued a record number of alerts, monitoring over 1,600 disaster events, while cities like Bauru digitized SINAN to speed dengue reporting.[391] With stronger financing and deeper integration of predictive analytics, these tools can further strengthen preparedness and deliver more equitable protection across regions.



Estimates account that Brazil could hold up to **10% of world's NbS mitigation potential**

FOTO: JULIANA CARLA

V. Financial Innovation: The Critical Enabler of Climate Solutions

Unlocking the potential of Brazil's climate solutions will depend on mobilizing capital at scale. From early-stage innovation to large-scale deployment, climate solutions require financing to prove new models, expand enabling infrastructure, and de-risk investments that can crowd in diverse forms of capital. Yet most remain constrained by financing gaps across the innovation-to-scale continuum. Early-stage ventures struggle to access catalytic and concessional capital to validate new technologies or production models. Mid-stage solutions face limited instruments for de-risking and aggregation, keeping transaction costs high and project pipelines fragmented. And even mature sectors (e.g., restoration, renewable energy, or regenerative agriculture) require long-term vehicles that can blend commercial, philanthropic, and public funds to sustain expansion and attract institutional investors.


FOTO: JULIANA CARLA

Brazil is beginning to close these gaps through innovative approaches that are being developed in an evolving climate finance ecosystem that brings together different types and blends of capital. Innovative partnerships are piloting blended vehicles, guarantee facilities, currency hedging mechanisms, and securitization platforms that align incentives, reduce risk, and pool smaller projects into investable portfolios. Many of these initiatives are already open to both domestic and international investors, offering immediate opportunities to participate in Brazil's climate ecosystem. At the same time, the models being tested provide valuable blueprints for other emerging markets facing similar financing constraints. Strengthening and replicating these mechanisms will be key not only to sustaining Brazil's own momentum but to advancing global progress on climate innovation and investment.

Case Study 1: Eco Invest Brazil

FACILITY TO DE-RISK AND CROWD IN PRIVATE CAPITAL FOR CLIMATE INVESTMENTS

- **The problem it tackles -** Foreign investors have long been deterred from Brazil's climate opportunities due to two barriers: high currency risk and expensive local credit. These factors limit the bankability of projects in renewable energy, sustainable agriculture, and forest restoration, even when the fundamentals are strong.
- **The financial innovation -** Eco Invest, led by the Ministry of Finance with BNDES, Banco do Brasil, IDB, and the World Bank, pools public and development finance to de-risk private capital. Its key innovation is the use of competitive auctions to allocate four tools — Foreign exchange risk mitigation, liquidity support, concessional finance, and project-preparation credit. Institutions bid on how much private capital they can mobilize and what results they will deliver, ensuring resources flow to the actors with the highest catalytic impact.[392]
- **Proof of traction -** The first auction in 2023 mobilized US$8.5 billion for renewable energy, biofuels, and reforestation, with a leverage ratio of nearly 7:1 (US$7.1 billion private to US$1.4 billion public).[393] The next auction, planned for 2025, is expected to channel US$5.8 billion toward restoring 1.4 million hectares of degraded land by 2027.[394]
- **Why it matters globally -** Eco Invest demonstrates how tackling both market risk through FX hedging and project-level risk through targeted technical assistance can crowd in domestic and foreign private capital at scale. For international funders, it offers an immediate, risk-mitigated entry point into Brazil's ecological transition and a replicable model for other emerging markets.

Case Study 2: KPTL (Amazon Regenerate Fund and Forest & Climate Tech Fund)

BLENDED VENTURE CAPITAL FOR EARLY-STAGE CLIMATE INNOVATION

- **The problem it tackles –** Enabling Brazil's potential to develop climate solutions cannot rely only on large-scale infrastructure. It also depends on entrepreneurs piloting new models in bioeconomy, regenerative agriculture, and low-carbon technologies. Yet early-stage climate ventures in Brazil face a funding gap: they are often too risky for commercial capital and too capital-intensive for grant funding, leaving them stuck between innovation and scale.
- **The financial innovation -** KPTL, one of Brazil's leading venture capital firms, launched two blended funds — the Amazon Regenerate Fund and the Forest & Climate Tech Fund. Their structure layers philanthropic first-loss capital and concessional finance from DFIs with private investment from global and Brazilian family offices and corporates. This design reduces downside risk for commercial investors while giving startups longer ten-year fund lifespans to prove their models, an uncommon feature in emerging-market venture capital (VC)*.
- **Proof of traction -** The Amazon Regenerate Fund has raised US$30 million and built a portfolio of 15 startups, such as Ponta (digital platforms for sustainable forest management) and Bug (bioinputs). The Forest & Climate Tech Fund has mobilized US$50 million to invest in 20–30 ventures. Together, the funds are expanding the pipeline of investable climate solutions in Brazil.[395]
- **Why it matters globally -** KPTL offers a replicable model of blended finance leveraging venture capital that can unlock early-stage climate innovation in emerging markets. For international funders, it also provides a direct opportunity to engage with Brazil's venture ecosystem, which is channeling capital and expertise into the country's climate space.

Case Study 3 : FUNSES III: Espírito Santo Decarbonization FundTech Fund

BLENDED SUBNATIONAL FACILITY TO ACCELERATE CLIMATE GOALS

- **The problem it tackles -** Subnational governments face the dual challenge of delivering ambitious climate outcomes while carrying higher perceived risk than sovereigns and operating with less mature public financial institutions. These constraints make it harder to mobilize private capital at scale, even when strong transition plans are in place.
- **The financial innovation -** FUNSES III is Brazil's first subnational sovereign wealth backed fund for decarbonization. It is structured as a blended finance FIDC (Fundo de Investimento em Direitos Creditórios) —a regulated credit receivables investment fund that anchors concessional state capital to de-risk private investment and channel resources into climate projects. By adapting an FIDC, a familiar domestic instrument, it creates a clear, replicable mechanism for scaling climate finance at the subnational level, mobilizing funds across energy, industry, transport, waste, and AFOLU.
- **Proof of traction -** FUNSES was created in 2019 and has an endowment of more than US$300 million. FUNSES III was launched in 2025 with an initial US$94 million anchor from Espírito Santo's sovereign wealth fund, with an 8–15-year horizon and a target return of inflation + 1.5%. While too early for realized results, the fund has a strong track record delivering impact: previous vehicles have mobilized US$50 million for 227 startups and ESG-oriented projects, underscoring its ability to operationalize innovative finance at scale.[396]
- **Why it matters globally -** This fund demonstrates how subnational finance can be structured to deliver climate outcomes in contexts where country-level funding is limited. By blending state capital with private investment, it reduces risk perception and builds investable pipelines. Beyond emissions reduction, it also drives regional innovation and economic opportunities. For funders, it offers an opportunity to engage with innovative state-level vehicles and a template for replication elsewhere.

Case Study 4 : Brazil Climate & Ecological Investment Platform (BIP)

BLENDED VENTURE CAPITAL FOR EARLY-STAGE CLIMATE INNOVATION

- **The problem it tackles –** Global investors often struggle to find credible, large-scale opportunities in emerging markets, while promising projects face barriers accessing capital. In Brazil, this gap has left many climate and ecological investments fragmented, underfinanced, or misaligned with investor requirements.
- **The financial innovation -** BIP serves as a national platform that curates, vets, and matches projects with the right sources of capital. Rather than being a fund, it functions as an orchestrator across renewable energy, sustainable agriculture, nature-based solutions, and the circular economy. By aligning investor priorities with national climate goals, it reduces fragmentation, increases transparency, and accelerates the flow of capital into Brazil's climate solutions platform.
- **Proof of traction -** BIP has already approved 16 projects into its pipeline with ambitions to mobilize more than US$20 billion in funding. As of 2025, the pipeline includes the Sierra Verde mineral operation (US$1.1 billion), a low-carbon steel and aluminum facility for Vale (US$2.6 billion), the Fortescue/Pecém green hydrogen project (US$3.6 billion), among others.[397]
- **Why it matters globally -** BIP is a model on how a national platform can serve as a market-wide public good by linking verified climate projects with domestic and international capital. By consolidating different climate solutions into a single, structured pipeline, it helps overcome information asymmetries that constrain investment. For funders, it offers an accessible, existing investment gateway for Brazil's climate solutions, and a replicable model for other markets.

Case Study 5 : Nature Investment Lab

COLLABORATIVE PLATFORM TO UNLOCK INVESTMENT IN NATURE-BASED SOLUTIONS IN BRAZIL

- **The problem it tackles -** Financing for Nature Bases Solutions (NbS) in Brazil is not constrained by a lack of ideas, but by systemic inefficiencies. Innovation is siloed, coordination across actors is weak, and early-stage ventures lack acceleration mechanisms. Regulatory hurdles, high transaction costs, and limited access to technical assistance make it harder for promising climate solution models to attract capital and scale.

- **The financial innovation -** Nature Investment Lab (NIL) addresses these barriers by acting as a collaborative platform rather than a single vehicle. It convenes financial institutions, philanthropies, businesses, and civil society to co-design solutions through three task forces on policy and regulation, innovative transactions, and transaction costs and impacts. It also supports early-stage NbS businesses with technical assistance and prepares them for participation in larger blended-finance mechanisms, building a structured and replicable pipeline of investable projects.

- **Proof of traction -** Since its launch in 2024, NIL has brought together a coalition of major banks, international organizations, and philanthropies. Its first public call in 2025 attracted 86 NbS businesses, with five selected to receive technical support. Together, these companies are developing strategies to mobilize US$73 million, restore 126,000 hectares, benefit 15,000 families, and remove 540 million tons of CO_2 by 2030.[398]

- **Why it matters globally -** NIL demonstrates how collaborative platforms can address systemic barriers that hold back innovation and funding for NbS. By tackling regulatory gaps, transaction costs, and access to technical assistance, it creates the enabling conditions for ventures to scale. For funders, it offers both a replicable model for building coordinated NbS investment ecosystems and a live pipeline of projects and opportunities in Brazil.

VI. Seizing the Opportunity: How Global Partners Can Engage

Brazil's growing ecosystem of climate innovation offers global partners tangible opportunities to advance decarbonization, resilience, and sustainable growth. Realizing this potential will require collaboration that combines finance, technical expertise, and policy engagement to unlock viable, scalable solutions. This section highlights three complementary pathways for engagement: investing directly in Brazil's climate solutions, embedding them in global supply chains, and adapting successful Brazilian models abroad.

Across these pathways, donors can take catalytic risks that others cannot, investors can scale models already proven and de-risked in Brazil's markets, and corporates can anchor low-carbon supply chains through strategic procurement and partnerships. Progress will move fastest through trusted intermediaries such as iCS, which convene actors, reduce barriers, and align investment toward shared climate and development goals.

1. Invest in Brazil's Solutions to **Deliver Climate Outcomes**

Brazil's climate solution ecosystem includes promising startups, growth-ready firms, and large-scale projects that require different types and blends of capital. Funders and investors can engage through high-impact entry points such as backing early-stage ventures, unlocking growth finance, and catalyzing greenfield infrastructure.

Back early-stage ventures and entrepreneurs - Promising innovations like microbial bioinputs, biochar, or AgTech platforms for soil and crop monitoring risk stalling without patient, risk-tolerant capital and non-financial support. Philanthropy and global donors can provide seed capital, fund accelerators and proof-of-concept labs, and deliver technical assistance to entrepreneurs and R&D centers. Once viability is demonstrated, international investors can step in — partnering with local funds such as KPTL to co-invest directly in ventures or taking positions in blended VC funds that provide de-risked exposure to Brazil's climate innovation pipeline.

Unlock growth finance for commercially ready firms - Brazil already has producers of Sustainable Aviation Fuel (SAF), bioethanol, and bio-based construction materials. These firms face bottlenecks in scaling production capacity and improving cost efficiency. Philanthropy can fund applied R&D, support certification of quality standards for export, or provide guarantees that unlock commercial debt. As risks fall, growth equity and working capital loans can flow from investors. For example, the Raízen–Shell joint venture on cellulosic ethanol illustrates how concessional capital and corporate demand can crowd in large-scale investment.

Catalyze greenfield infrastructure at scale - Strategic climate projects such as green hydrogen infrastructure and nature-based solutions can deliver strong returns for both investors and the climate, but they often require catalytic capital and risk-sharing to become investable. Philanthropy can de-risk through guarantees, blended structures, and feasibility funding, while working with Brazil's technical institutes and local partners to build robust, evidence-based pipelines. In parallel, foreign investors can deploy structured project finance and growth equity, partnering with Brazilian developers, R&D hubs, and industrial players.

2. Integrate Brazilian Solutions into **Global Supply Chains**

Brazil can supply the world with resilient, low-carbon commodities and industrial products — if certification, industrial capacity, and demand gaps are bridged. For funders and investors, key opportunities include expanding feedstock production, developing renewable-powered industrial hubs, and securing long-term demand.

Expand sustainable feedstock and input production – Brazil can supply global markets with low-carbon inputs, from certified soy to bioinputs and transition minerals. Yet weak certification, fragmented logistics, and limited farmer and SME inclusion constrain integration into supply chains. Philanthropy and sovereign funders can fund certification and traceability systems and strengthen producer capabilities. Investors and corporates can finance processing hubs, agro-industrial ventures, and mining projects through joint ventures with local players. Acelen's partnership with local biotech MulticanaPlus to expand macaúba for biodiesel shows one example of how to scale sustainable feedstock production for global export.

Develop renewable-powered industrial hubs ("Powershoring") - Brazil's cost advantage in renewable energy positions its industrial base to attract relocation from higher-cost markets while supplying low-carbon inputs to global supply chains. Hard-to-abate sectors such as steel, cement, and fertilizers, along with new industries like data centers and tech manufacturing, can scale through renewable-powered hubs. Multilateral or bilateral financing can fund feasibility studies, provide safeguards, and deploy blended structures to de-risk early projects. Investors and corporates can finance industrial assets at scale, as shown by Hydro Rein's wind-to-alumina deal anchored by corporate PPAs.

Secure reliable demand through offtake agreements - Even with inputs and industrial capacity, Brazil's solutions cannot scale without reliable buyers. Long-term demand for advanced biofuels, bio-based materials, and low-carbon industrial goods is essential to attract sustained investment. ODA can catalyze this by brokering partnerships with private sector actors, while MDBs can finance matchmaking platforms and generate market intelligence for investors. Building on this, corporates and investors can secure offtake agreements and joint ventures that stabilize revenues and embed Brazil's production into global climate-aligned trade flows.

3. Replicate Distinctive **Brazilian Models Abroad**

Brazil is already generating distinctive climate models and innovations that can be adapted in other geographies. Funders and investors can engage through entry points such as codifying policy and technical know-how, piloting globally relevant models, and scaling proven innovations internationally.

Codify and share climate policy and technical know-how - Brazil has pioneered frameworks such as Pró-Floresta (carbon offsets with safeguards) and AdaptaBrasil (municipal-level risk intelligence). Yet organizations outside Brazil, have limited awareness of their potential. Philanthropy can fund South–South policy dialogues, global knowledge platforms, and translation of technical standards. Multilaterals can underwrite technical cooperation across regions. Investors can finance enabling services such as Monitoring and data enabling systems firms or environmental service models that are delivering climate and sound financial outcomes.

Pilot globally relevant models in Brazil's biomes - Brazil's diverse ecosystems, from the Cerrado to coastal regions, make it an ideal test bed for climate solutions with global relevance. Piloting nature-based and adaptation models in these contexts allows funders to generate rigorous evidence on their climate, social, and economic performance under varied ecological and governance conditions. Philanthropy and global funders can finance this testing and independent evaluation to identify which models are most effective and with high replication potential. Multilaterals can provide blended finance and technical cooperation to validate business models and standards that can travel across borders. For example, mangrove restoration in Recife could inform coastal protection models in Southeast Asia.

Scale Brazilian innovations globally – From AgTech to bioinputs to integrated climate–health adaptation systems, Brazil holds models that are ready for deployment abroad. Donors can fund pilots of these models abroad and broker cross-border partnerships. Corporates and investors can expand through joint ventures, licensing models, or scaled financing. For example, Brazilian biofertilizers could be piloted in tropical Asia with philanthropic de-risking, before investors finance large-scale production.

Brazil can supply the world with resilient, low-carbon commodities and industrial products

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