Earth4All: **Brazil**

Five turnarounds towards wellbeing for all within planetary boundaries

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Foreword: An introduction to **Earth4All: Brazil**

Brazil's biomes are nearing tipping points that could flip them from carbon sinks to sources. The impacts would be devastating resulting in expanding emissions, collapsing biodiversity and destabilising water and food. In the Amazon, deforestation and global warming-induced severe droughts and heat weaken "flying rivers", pushing savannization. The Cerrado's conversion erodes deep-rooted vegetation and soil carbon, driving a drier, fire-prone state. The Caatinga faces intensifying aridity and land degradation, locking in desertification. The Pantanal's flood pulse is disrupted by upstream loss and warming, swinging between extreme floods and mega-fires. In the Mata Atlântica, fragmentation cuts connectivity, accelerating species loss and reducing watershed reliability. Unchecked, these shifts cascade: less rain, more smoke, lower yields, and mounting health and economic costs.

Brazil faces a turning point. Like many other parts of the world, its actions to advance climate and nature goals are slowed by political pushback, deep inequalities, corruption and organised crime. But if measures to safeguard climate and nature are delayed, a wide range of devastating risks will accumulate. On the other hand, if Brazil and its partners move together on more ambitious climate and environmental actions, promoting green jobs, addressing systemic inequalities, and disrupting illicit markets, it can grow in a way that is cleaner, safer and more equal. These are the central messages of this new Earth4All assessment. The findings are refreshingly straightforward: climate stability, social cohesion and shared prosperity rise or fall together. Push one without the others and progress stalls. Advance them together and Brazil can unlock a step-change in emissions reduction, environmental protection to avoid biomes' tipping points, economic competitiveness, fiscal stability and human flourishing.

What sets the Earth4All study apart is its innovative, transparent and scientific approach focusing on an equitable transition. The research team applied a system dynamics framework that focuses on Brazil's development pathways from 2025 to 2050. It explicitly couples mitigation and adaptation opportunities and risks with political, social and economic dynamics. Earth4All has mapped out 12 feedback loops that show where the system pushes back, where actions reinforce each other and where trade-offs are most consequential. It is not just a robust research assessment: it is a decision tool that can help leaders decide what to do first, what to bundle and what to avoid over the coming decades.

Most important, the assessment shows that delays entail real costs and could contribute to dangerous tipping points. It also reveals how persistent poverty, inequality, migration, resource pressure and the politics of fossil fuels and land reform can potentially weaken trust and slow climate action. While avoidable, a "Too Little Too Late" path could accelerate climate and environmental risks with catastrophic outcomes for Brazil and the world. The good news is that a faster, fairer path exists. Coordinated turnarounds in poverty, inequality, empowerment, food and energy systems can align climate goals with social cohesion and shared prosperity. What is more, public opinion is already ahead of policy: most Brazilians want ambitious climate action that promotes cleaner energy, less pollution and more voice for all citizens.

Land is a strategic game-changer after 2030. If public authorities and civil society can enforce the forest code, restore degraded pastures, recognise Indigenous and Afro-descendant lands and help farmers adopt more efficient practices, land-use emissions can flip from positive to negative within five years. That means forests recover, biodiversity returns and rural incomes rise. To make this an investable proposition, Brazil should scale performance-based loans and blended finance that pay for high integrity restoration and smallholder gains, while rewarding municipalities that meet forest code compliance. Agriculture and livestock can also cut methane through pasture intensification, feed supplements and manure treatment,

opening doors to deforestation-free markets for beef, soy and cellulose. Global demand will still set a floor for farm emissions, but Brazil can own the ceiling with productivity, traceability and zero-deforestation and degradation supply chains.

Clean power and reliable grids are fundamental. Electricity in Brazil is already over 88% renewable, but policy will determine how fast and how affordable the transition will be. The fastest-action pathway identified by Earth4All ensures more wind and solar plus storage so power is reliable at night and during droughts, cutting emissions and keeping bills steady over time. Priorities include expanding transmission to wind- and solar-rich regions, setting clear targets for firm capacity and storage, and adding demand-response and efficiency for energy-intensive industries and consumers. In transport, it is also essential to scale sustainable biofuels and aviation fuel with rapid electrification of buses and urban delivery fleets to clean the air where people live and breathe. Together with land protection, these steps can deliver the biggest near-term drops in smoke, urban pollution and reduce greenhouse gas emissions so as to enhance human quality of life factors whilst de-carbonising.

Managing the fossil fuel transition wisely will protect the economy. Brazil risks moving in the wrong direction if it proceeds with drilling in the Equatorial Margin at the mouth of the Amazon. Indeed, as the world uses less fossil fuel, many refineries and fields risk losing value. The Earth4All model shows these risks rising in the 2030s, mainly from refining overcapacity. Brazil can manage such risks by pacing exploration and upgrades to realistic demand, investing today's hydrocarbon income in cleaner grids, green mobility, restoration, and skills, and stress-testing new projects under conservative prices. A fair price on pollution can shield trade-exposed industries if rebates depend on real decarbonisation plans, while revenues lower electricity bills and support small businesses that go green. Smarter taxes on wealth and dividends reduce inequality, build trust, and strengthen the state's ability to enforce the rules.

This Earth4All report reminds readers that trust itself is a climate policy. When people see fair rules and real benefits, trust grows. With more trust, enforcement works and crime falls, forests recover and investments flow. Without it, we cannot ensure turbulence does not derail progress. Tracking a few basic metrics that everyone understands, like hectares restored, storage added, refinery utilisation and the inequality index, signals seriousness and aligns ministries and markets.

Brazil has the renewable resources, natural capital, diverse economy and democratic tools to lead a new chapter of development within planetary limits. Achieving these objectives will not be straightforward, not least as elite resistance is likely to be strong and politics continue to divide. Success means moving climate, equity and jobs together: removing incentives for deforestation and degradation; diversifying beyond hydro to wind, solar and storage; expanding credit and services for smallholders and regenerative practices; strengthening women's leadership and social protections; and publishing clear progress metrics. With clear rules, fast and predictable licensing and bankable project pipelines, private capital will follow. If leaders match public resolve with evidence-based, accountable action, Brazil can weather turbulence, regenerate its biomes, decarbonise its economy, reduce inequalities and prove that a fair, fast transition is not only necessary but within reach.

As we face these collective challenges together, I welcome this new report as an offering of pathways forward.

Dr. Carlos Nobre
Chair, Earth4All Brazil, Transformational Economics & Planetary Science Commission
Co-Chair, Science Panel for the Amazon
Earth System Scientist, University of São Paulo

Executive summary

Many of the solutions to large existential challenges such as climate change and biodiversity loss are already widely known: transform our energy, transport and industry sectors and protect forests. But if we know the solutions, why are we not making progress? Restating the solutions won't help. We need to reassess the problem.

At Earth4All, our analysis shows that the core of the problem is trust and social cohesion. The world is often failing to make progress because there is not enough trust in governments to take long-term decisions for the benefit of the majority of people. Greater trust in institutions and greater social cohesion are the key factors for success.

This Earth4All report focuses on how Brazil can enhance trust and social cohesion to address climate change. It is an initial response to growing calls by the Brazilian COP30 Presidency and President Luiz Inácio Lula da Silva for an equitable and just transition. Brazil will only achieve its climate and development goals if action focuses on institutions and rules that improve trust and social cohesion. This is hard work, not least because vested interests and deep structural inequalities push back at every turn.

The analysis in this report shows how coordinated, fair policies can overcome resistance and deliver faster, shared gains towards de-carbonisation goals and equitable economic development. It explores five turnarounds – poverty, inequality, empowerment, food and energy – that will shape forward momentum and considers how different policy paths will influence, and be influenced by, social cohesion, prosperity and climate targets in Brazil. We propose that further analytical studies build on this by adding more context-specific variables, complexity and greater stakeholder engagement across the five extraordinary turnarounds proposed.

The report is informed by system dynamics modelling, qualitative research, public surveys of attitudes to economic systems change and expert inputs from the Transformative Economics and Planetary Science Commission. It offers a range of possible future scenarios for Brazil related to land use, energy, climate and social equity. The report considers scenarios that are "Too Little Too Late" (living outside the limits of the planet) and others that offer a "Giant Leap" to live within planetary boundaries at both the national and global levels. By testing the interplay of five key turnarounds, this report reveals, as shown in previous national and global reports, that ambitious and aligned action when targeted to specific geographical challenges can deliver economic wellbeing and resilience to future shocks and stresses. By contrast, incremental decision making as usual approaches are likely to intensify ecological risks, the economic and human costs of inaction and social tensions.

Selected findings

The present report offers an initial high-level view of major climate, social and economic changes by 2050. It finds that whatever pathways Brazil pursues has significant national and indeed global consequences. An overarching observation is that the Brazilian government, private actors and civil society must create the conditions for systems transformation based on rebuilding trust and social cohesion. Deepening climate–social–economic synergies are essential. The analysis pinpoints where interventions can simultaneously advance multiple goals and where risks must be avoided. The analysis finds that Brazil has the potential to offer pathways that can be adapted by other nations.

Policies that support social cohesion and inclusive prosperity in Brazil are essential to catalyse the restructuring needed for net zero and systemic risk reduction. The report shows how systems modelling can deepen understanding of these interdependencies. It also supports the COP30 Presidency's agenda by

indicating the importance of connecting climate mitigation and adaptation with social and climate justice.[1] By revealing how climate policies are fundamentally connected to social cohesion, the report offers testable hypotheses and fresh insights. The goal is to provide pragmatic and evidence-informed recommendations that can inform policy design and sequencing, prioritise trade-offs and accelerate progress.

Earth4All developed four scenarios to test how multiple combinations of national and global action could shape Brazil's future across poverty, inequality, empowerment, food and energy systems (see Figure 1). Each scenario offers a narrative framework that describes different possible futures. The scenarios were tested for consistency and processed through by system dynamics modelling efforts. The Earth4All team generated a set of quantitative/qualitative outputs that are summarised below and described at length in the report.

The four scenarios simulate distinct development pathways for Brazil based on the outcomes of limited, unilateral or synchronised multilateral reform. Each scenario explores how differentiated levels of ambition at the national and global levels influence poverty reduction, inequality, empowerment, food systems and energy transition. The four scenarios reveal dramatically different futures for Brazil's climate and development.

Figure 1. Four scenarios for Earth4All

Scenario 1	Scenario 3
National Too Little Too Late **Global Too Little Too Late**	**National Giant Leap** **Global Too Little Too Late**
Weak national and international progress. Brazil is exposed to persistent climate and social-tension risk.	Strong national action even with weak global actions, can still drive substantial domestic transformation. Our analysis finds that national measures can dramatically expand renewables, eradicate poverty, reduce inequality, empower women and regenerate rural economies, although gains may be constrained by international factors.
Scenario 2	**Scenario 4**
National Too Little Too Late **Global Giant Leap**	**National Giant Leap** **Global Giant Leap**
Strong global action, weak national action. International advances lead to significantly lower emissions, reducing some climate risks (though Brazil has very specific, localised challenges (currently not modelled), but inequality persists, rural transformation is comparatively weak and social cohesion is compromised.	Strong national and international action. This is the most successful scenario that combines ambitious national and global transformation. The model finds that combined action can yield rapid decarbonisation, more inclusive prosperity, significant declines in inequality and resilient, empowered societies. Synchronised action at both levels is essential for lasting results.

[1] See https://cop30.pactoglobal.org.br/index.php/en/home-english/.

The Brazilian public support economic systems change and stronger, fair climate action

Earth4All conducted a major survey of Brazilian attitudes to economic and political systems change and the connection to climate risk. Public sentiment favours rapid action in Brazil. Key findings:[2]

- **92% of Brazilians** are deeply concerned about the state of nature.
- **78% agree** Earth is approaching dangerous tipping points.
- **81% agree** that major action on climate and nature – across all sectors of the economy – is needed this decade.
- **Just one in three (35%)** believe Brazil is doing enough to protect the climate and nature.
- **76% agree** there is too much inequality in Brazil.
- **Two out of three** Brazilians believe wealthy people should pay more income tax and taxes on their wealth (70% and 69%).
- **Just 38%** believe the government can be trusted to make decisions for the majority of the people.
- **81% of Brazilians** believe the political system needs complete transformation or major reforms.
- **83% believe** the economic system needs complete transformation or major reforms.
- **72% of Brazilians** support the idea of citizens assemblies to increase citizen influence in decision making.

Taken together with other surveys (see conclusions), the data portray a Brazilian public that is anxious yet pragmatic, acutely aware of ecological risks and broadly supportive of transformative change linking climate action with social justice. The challenge for policymakers is to translate this favourable sentiment into credible delivery, with institutional transparency, inclusion and accountability. The strong public mandate presents a real opportunity. If Brazilian leadership aligns policy ambition and investment with this social undercurrent, it could accelerate the transition to a greener, more equitable economy.

Progress requires social cohesion as an essential pre-condition

The path to progress requires support for long-term, multi-generational policies that are broadly embraced by the majority of Brazilians. The policy proposals proposed by Earth4All in previous exercises and for Brazil combine climate goals with an emphasis on cohesion and prosperity. In the specific case of Brazil, advances will come through steady system rewiring such as enforcing forest restoration, expanding beyond hydro, adapting rural economies and reducing inequalities. Public performance metrics linked to, inter alia, hydro reliability, renewables with storage, forest regeneration, smallholder incomes, inequality, women in leadership and social cohesion should be published and assumptions updated openly to build trust. With disciplined policy and accountability, each step will ease the next, delivering a cleaner grid, safer biomes and a fairer economy.

[2] See https://earth4all.life/global-survey-2024/

Elite perceptions are the critical feedback loop

The strongest political constraint to progress in Brazil is the balancing loop triggered by perceived deprivation among elites as inequality declines. If left unaddressed, it can sap trust and shrink the state's capacity to act across multiple fronts, including climate mitigation and adaptation. Recent debates illustrate the point. Congress rejected creating a wealth tax in the 2024 tax reform package after intense pushback from high-income interests and their allies, limiting fiscal space for equity-enhancing measures.[3] At the same time, powerful agribusiness and extractive lobbies advanced legislation to weaken environmental licensing (the so-called "devastation bill") which critics warn would fast-track mining, infrastructure and agricultural projects with lighter oversight, increasing deforestation and pollution risks just as Brazil prepares to host COP30.[4,5]

Brazil can turn assets into durable gains

Brazil enters the coming decade with renewable potential, natural capital, a diversified economy and democratic capacity for course corrections. This report suggests turning those assets into durable gains by removing forest-clearing incentives; diversifying beyond hydro to wind, solar and storage; strengthening virtuous loops with targeted credit, services and gender-inclusive leadership; and tuning stabilisers to prevent cascading shocks. Building political durability requires anticipating push-back, linking climate action to competitiveness, security and jobs and transparently sharing benefits to unite a broad coalition.

Preliminary recommendations

Brazil can meet climate and development goals through coordinated action across land, energy, finance and social policy (see Figure 2). The Giant Leap scenario can cut emissions and reduce inequality while strengthening trust and state capacity. The report finds that land is the post-2030 game-changer and smart policies and investment can potentially flip the sector from source to sink. Meanwhile, faster grid build-out, storage and clean transport deliver quick air-quality and productivity gains. By contrast, the Too Little Too Late scenario will lock in higher warming, deepen social strain and increase stranded-asset risks in refining. Even so, equity-centred measures can turn potential backlash into buy-in, accelerating implementation and compounding benefits for health, resilience, security and competitiveness.

Brazil requires a coordinated and reliable system that spots tipping points early and acts fast. That means a permanent team that brings together key ministries such as environment, planning, finance, energy, agriculture, health and justice with the power and budget to respond when warning signs appear whether rising deforestation, expanding wildfires, drying rivers or otherwise. It also means working side by side with Indigenous and traditional communities in high-risk areas, building a national "tipping points" network that shares real-time data from satellites, weather, water and health agencies, and setting local compacts that pair tough enforcement with farm support, credit and social protection.

Globally, Brazil can champion a Global Climate and Nature Council (as advanced by Brazil's COP30 presidency) to turn the best science on tipping points into shared, real-time warnings and coordinated action across the UN system. Such a council would bridge today's fragmented climate–nature governance by linking UNFCCC, biodiversity, health, trade and finance processes and recommend rapid, jointly financed responses when thresholds are crossed. It would also help align debt, trade and investment with no-deforestation rules and strong social safeguards, while setting traceability and recycling standards for critical minerals to protect high-biodiversity and Indigenous territories. This proposal builds on President Lula's call - first aired at the 2024 G20 - for a UN-level body with stronger implementation capacity, with the UN General Assembly as the venue to explore institutional design and political backing.[6]

[3] See https://drassetplanning.com/en_us/brazil-chamber-of-deputies-rejects-creation-of-wealth-tax-in-tax-reform/
[4] See https://news.mongabay.com/2025/07/brazils-congress-passes-devastation-bill-in-major-environmental-setback/
[5] See https://www.bbc.com/news/articles/cy98jqr4p0xo
[6] See https://igarape.org.br/en/global-futures-bulletin-towards-a-global-climate-and-nature-council/ which details the proposal

Accelerate poverty reduction

Earth4All's modelling shows two sharply different trajectories. With weak domestic reform, even if the world improves marginally, poverty dips briefly, then rises as climate shocks, inequality and vulnerability compound. Ambitious national policy on its own drives steep reductions and higher resilience, but without global reforms in climate cooperation, trade or finance, complete eradication remains out of reach. Only the joint national-and-global Giant Leap scenario achieves eradication before 2040, locking in wellbeing and protection against future shocks.

To scale impact, Brazil should ensure inclusive, climate-aware delivery of Bolsa Família and the Ecological Transformation Plan (EPT),[7] so cash support, jobs and adaptation are mutually reinforcing. A climate-poverty sovereign wealth fund co-governed by Indigenous, Afro-descendent and other marginalised communities and capitalised by green bonds and redirected fossil subsidies can finance resilient infrastructure and social protection transparently.[8] Deepening participatory governance, multi-level collaboration, and integrated modelling can also build trust, counter polarisation and tie citizen voices to measurable outcomes. Key will be to put in place financial and taxation packages that don't penalise Brazilian citizens especially those on low-incomes.

Make inequality reduction a priority

Sustained inequality reduction appears only in scenarios with strong domestic reforms, or best of all, coordinated domestic and global ambition. Without this, inequality plateaus at high levels or rebounds after short-lived gains, eroding social trust and slowing progress on gender and inclusion. The risks of inequality feeding organised crime and social tension are very real, hence as discussed above financial and taxation packages must penalise the wealthiest and the greatest polluters.

Policy priorities include a more progressive tax mix such as wealth and ecological contribution taxes earmarked for social protection and adaptation, pilots for local property/land taxation, and radical transparency via digital fiscal tools and citizen oversight. Framing wealth taxation as a unifying mechanism that links fairness to climate resilience, backed by case studies and open budgets, and as a case for social cohesion and economic stability can also potentially broaden acceptance. Brazil could also lead a Global South tax cooperation hub, expand participatory budgeting, and invest in building awareness around the links between air quality and health, all within an integrated national transformation plan that reaches beyond siloed sector policies.[9]

Empower women and marginalised groups

Without broad reforms, empowerment advances slowly and leaves most women and marginalised groups outside decision-making, keeping governance fragile. By contrast, ambitious national and global action accelerates gender parity, societal and economic inclusion, strengthens institutions and decision making, and improves collective capacity to manage climate risk and social change.

Key enablers include scaling Brazil's participatory digital democracy platforms, deploying social impact bonds and empowerment-linked crowdfunding, and creating multi-level coordination bodies that connect federal, state and municipal learning. Gender-smart resilience in training, job placement and gender-responsive disaster policy in high-risk areas should be mainstreamed. Also, cultural dialogue, youth-led campaigns and embedding empowerment targets in adaptation finance and contingency plans can help dismantle entrenched gender/racial biases and boost women's economic agency.

[7] See https://www.gov.br/fazenda/pt-br/acesso-a-informacao/acoes-e-programas/transformacao-ecologica/novo-brasil-ecological-transformation-plan/0723_pte_digital.pdf
[8] See https://pppescp.com/2025/10/27/sovereign-wealth-funds-as-engines-of-capital-for-the-climate-transition/
[9] See https://www.gov.br/planalto/pt-br/media/18-11-2024-declaracao-de-lideres-g20.pdf

Create long-term food security and support improved nutrition

On land, the model projects large gains in secondary vegetation under robust policy packages, slashing land-use change emissions, one of Brazil's largest sources of greenhouse gasses.[10] Success hinges as much on enforcement as on economics: when clearing is risky and costly, regeneration pays. Yet crop emissions will continue to rise with area expansion and cattle intensification, and regenerative practices stall without stronger incentives, buy-in from agri business and markets. Only ambitious national and global reform flips the system toward sustainable, prosperous agriculture: sharp emissions decline, resilient landscapes, and rising rural incomes.

To get there, Brazil can tie rural credit and tax incentives to verified sustainability and traceability. Authorities can condition support on conservation compliance and low-carbon practices. Other priorities include real-time climate-resilience dashboards to integrate environmental, social and market data for public and private decisions. Brazil could also establish multi-stakeholder food and agriculture innovation hubs for rapid policy/technology testing, and scale outcome-based payments and participatory funding that accelerate restoration, resilience and nutrition equity, ensuring regenerative agriculture delivers ecological recovery and affordable, healthy diets.

Expand renewable energy and grids

Anchored as it is in hydropower, Brazil's power system is unusually clean for a major economy. Yet it is still exposed to rainfall variability and ongoing fossil exploration.[11] The modelling yields four futures: inaction stalls decarbonisation; global-led ambition brings moderate progress; domestic leadership triggers an early leap to clean power; and joint national and global ambition achieves the fastest, most robust shift to near-total renewables, with strong air-quality and energy-security gains.

Scaling the transition requires fast-tracking transmission to wind/solar corridors, setting clear storage and firm-capacity targets, and expanding demand response and modern inverter technologies to stabilise a renewables-heavy grid. Coordinated innovation hubs linking regulators, operators, communities and investors can "future-proof" the system against climate shocks. Maintaining a predictable, transparent auction schedule and investment pipeline cements Brazil's leadership by converting clean-power ambition into durable climate, competitiveness, and social benefits while positioning the country as a renewable superpower and model of a just transition.

[10] See https://climaesociedade.org/en/changes-in-land-use-account-for-48-of-brazilian-emissions/
[11] See https://lowcarbonpower.org/region/Brazil

Figure 2: Summary of key policy recommendations

POVERTY	Climate-Poverty Sovereign Wealth Fund with community governance.
	Enhance participatory mechanisms such as Conselhos de Politicas Sociais and ensure transparency in Bolsa Família and Ecological Transformation Plan outcomes.
	Amplify Brazil's Ecological Transformation Plan.
INEQUALITY	Wealth and ecological contribution taxes legally earmarked for social protection and climate.
	Pilot local progressive property and land taxes.
	Participatory budgeting.
	New narrative that positions wealth tax revenues as a catalyst for reducing inequality, poverty, and ecological vulnerability.
	Global South tax cooperation hub.
	Launch a task force on climate, air quality and health.
EMPOWERMENT	Scale the existing Participatory Digital Democracy Platform (Participativo Platform).
	Scale Brazil's social impact bonds with clear, outcome-based metrics that are aligned with empowerment goals.
	Multi-level coordination platforms.
	Enhance gender-smart resilience.
	Sustained cultural dialogue and advocacy.
FOOD	Rural credits and tax credits should be conditional on traceability.
	Establish real-time climate-resilient dashboards.
	Multi-stakeholder food and agriculture innovation hub.
	Innovative finance instruments, such as blended finance, outcome-based payments, credit facilities linked to nature-positive practices.
ENERGY	Fast tracking transmission expansion.
	Support variable generation multi-stakeholder innovation hubs.
	Future-proof the energy grid.
	Rapid auction schedule to meeting growing demand.

1. Introduction

Climate stability, social cohesion and shared prosperity rise or fall together. The only way to secure all three is to act across every sector at once. Looking at four possible futures, this report shows that the Giant Leap scenario, where Brazil combines bold national reforms with supportive global moves, can cut pollution quickly while also reducing inequality and creating better jobs. If we keep making decisions as usual and continue in the current context, change is Too Little Too Late, the country faces higher warming, more social stress, and growing financial risks as some oil and refining assets lose value. A transparent model maps how choices in land, energy, money and governance ripple through prices, health, jobs and nature, helping leaders decide what to do first, what to bundle and what to avoid.

The biggest opportunities are practical and close to home. On land, enforcing the forest code, restoring degraded areas, recognising Indigenous territories and reconverting pastures can flip land-use emissions from a problem to a solution while raising rural incomes. In energy, Brazil's already-clean electricity can move toward near-total renewables by expanding power lines, adding storage and cleaning up transport, bringing faster air-quality and productivity gains. Fairness policies make the transition stick including progressive taxes, targeted rural credit and carbon pricing with revenues returned to people and small businesses. This builds trust and speeds up implementation, especially when paired with gender-smart resilience. Together, these steps form a just, fast transition that regenerates biomes, improves health, attracts investment and secures wellbeing within planetary limits.

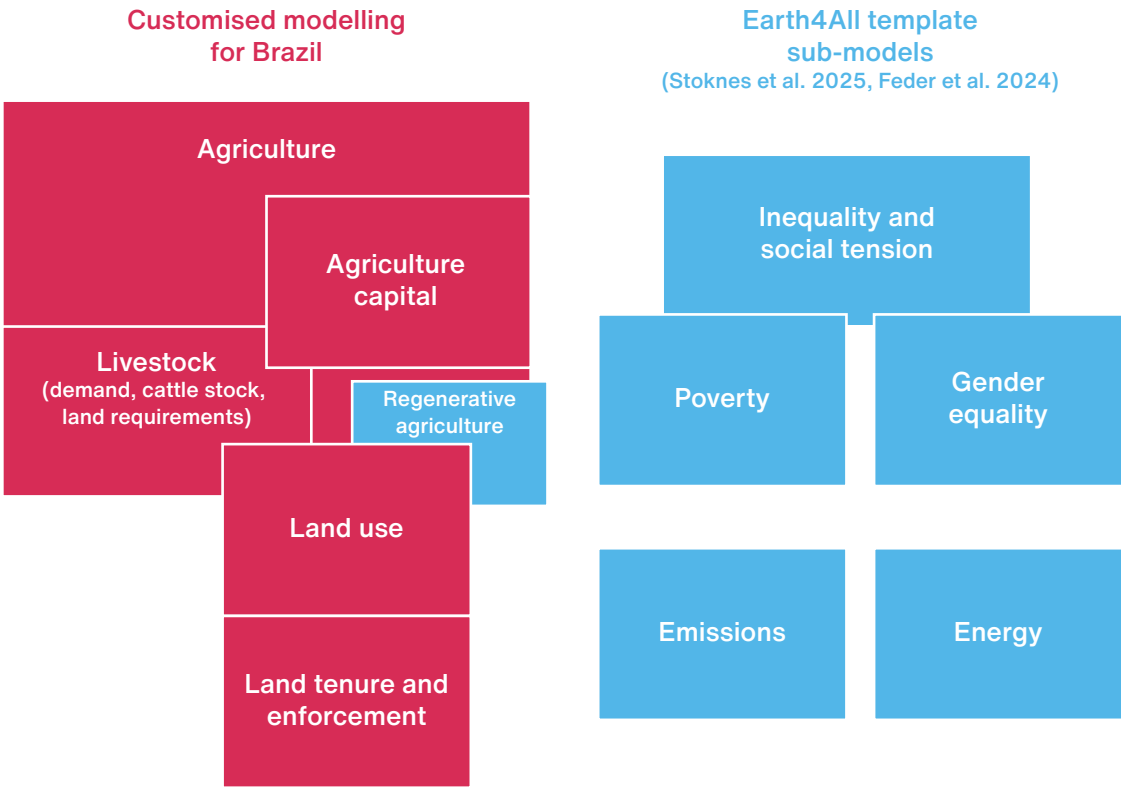
This report first explains the process of developing scenarios that are captured in a Brazil specific Earth4All system dynamics model linking climate mitigation and adaptation with social tensions, mapping feedback loops across land, energy, finance and governance to reveal where actions reinforce or resist change. Second, it presents preliminary modelling results, comparing alternative pathways and showing how different policy mixes affect emissions, equity, resilience and trust. Third, it distils a set of policy recommendations at varying levels of ambition including near-term "no-regrets" steps, scalable medium-term reforms and bold measures that can realistically be achieved with the right coalitions and financing. Finally, the conclusions set out practical next steps, including priorities for implementation, data and transparency needs and opportunities for collaboration among public, private and civil society actors.

2. Methodology

The integrated Earth4All scenarios and pathways presented in this report rely on qualitative research and expert input, which were tested in an adapted system dynamics Earth4All model for Brazil that offers a transparent and more systemic, Brazil-specific view of how mitigation, adaptation and social tensions interact. As this work has been conducted as a contribution to COP30 the existing Earth4All model structure was amended by model structures that capture land use dynamics (see Figure 3). Like all models, it offers a simplified representation of reality. Many connectors rely on assumptions regarding causal directions and lags. The Brazil-specific links and causal directions have been defined by a constrained literature review effort encompassing 165 documental sources. The lags and relationship strengths have been determined by a semi-automated calibration process.

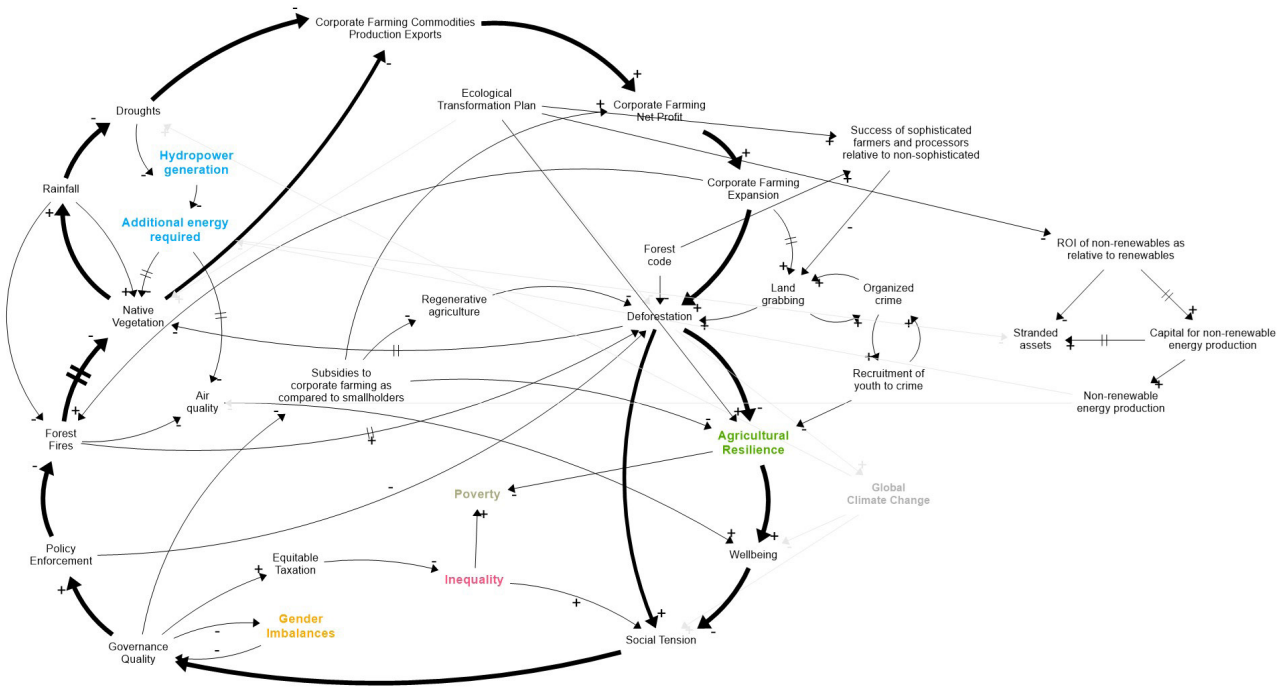
The simulation is based on a Differential Evolution algorithm that runs the model thousands of times to minimise the level of error when contrasting the simulations against 37 calibration datasets containing historical data for Brazil distributed across the various sub-modules within the model. Some variables face data gaps, and results are sensitive to parameter choices. The results are scenario narratives rather than predictive forecasts. Accordingly, the findings should be treated as first insights, subject to refinement as new evidence arrives, additional peer review is completed, and the land-use expansion and other modules are recalibrated and stress-tested against alternative assumptions.

Figure 3. Systems model adaptations for Brazil



The backbone of the model are the feedback loops presented in the causal loop diagram (see Figure 4). In total there are 11 key feedback loops. Nine of these loops are reinforcing, meaning they drive the system farther from equilibrium. These loops can operate in virtuous or vicious ways depending on the context, which can be influenced by policies. Balancing loops drive the system closer to equilibrium, which means policymakers can intervene to steer them to desired end-states.

Figure 4. Selected feedback loops



Earth4All developed four discrete scenarios to assess how different combinations of national and global ambition could shape Brazil's future across the five Earth4All extraordinary turnarounds: poverty, inequality, empowerment, food and energy systems (see Figure 1). The scenarios were designed to reflect different possible futures. These scenarios were tested through Earth4All's system dynamics model and generated a set of quantitative and qualitative outputs that are further described below.

Figure 1. Four scenarios for Earth4All

Scenario 1	Scenario 3
National Too Little Too Late **Global Too Little Too Late**	**National Giant Leap** **Global Too Little Too Late**
Weak national and international progress. Brazil is exposed to persistent climate and social-tension risk.	Strong national action even with weak global actions, can still drive substantial domestic transformation. Our analysis finds that national measures can dramatically expand renewables, eradicate poverty, reduce inequality, empower women and regenerate rural economies, although gains may be constrained by international factors.
Scenario 2	**Scenario 4**
National Too Little Too Late **Global Giant Leap**	**National Giant Leap** **Global Giant Leap**
Strong global action, weak national action. International advances lead to significantly lower emissions, reducing some climate risks (though Brazil has very specific, localised challenges (currently not modelled), but inequality persists, rural transformation is comparatively weak and social cohesion is compromised.	Strong national and international action. This is the most successful scenario that combines ambitious national and global transformation. The model finds that combined action can yield rapid decarbonisation, more inclusive prosperity, significant declines in inequality and resilient, empowered societies. Synchronised action at both levels is essential for lasting results.

The Too Little Too Late scenario illustrates what happens if actions are incremental and delayed, with limited momentum at national and global level, leading to stalled progress in renewables, rising poverty and inequality, persistent emissions and stagnant empowerment. By contrast, the Giant Leap scenario explores the transformative impacts of rapid, large-scale reforms and investments, either nationally, globally or both, resulting in a fast transition to renewables, near eradication of poverty, dramatic reductions in inequality, widespread empowerment and regenerative food systems. The big differences lie in speed and depth: Too Little Too Late means missed opportunities and compounding risks, while the Giant Leap delivers resilience, and inclusive prosperity by mid-century through systemic change.

By creating the four different combinations of national/global scenarios, Earth4All was able to investigate the consequences of limited, unilateral or synchronised reform. Each of the four scenarios explores how differentiated levels of ambition at the national and global scale directly impact outcomes for poverty reduction, inequality, empowerment, food systems and energy transition. The four scenarios show dramatically different futures for Brazil's climate and development. The main differences across the four scenarios stem from the relative ambition and effectiveness of domestic and international action.

3. Preliminary findings

The four scenarios reveal specific pathways for Brazil's climate and development future, but they are intentionally generic frames linking different social, economic and environmental challenges rather than detailed forecasts within a specific domain. They are simplified representations of complex realities and cannot capture every relationship, especially regarding regional heterogeneity, informal economies, political dynamics and behavioural responses that can accelerate or stall change. Results rest on assumptions about technology costs, policy execution, global demand and social responses that are plausible but not exhaustive. Indeed, alternative assumptions could shift outcomes materially. Interactions among sectors are stylised and based on a limited calibration process based on 37 time series, so compounding effects might be stronger or weaker than shown. In short, the scenarios are decision aids to test "what if's", not rigid predictions. Insights should be updated as new evidence emerges.

Scenario 1 | National Too Little Too Late | Global Too Little Too Late

In the first scenario, both national and global efforts stall, yielding only incremental change. Renewable energy stagnates, fossil fuels persist and emissions decline slowly. Poverty initially improves but reverses post-2040 while inequality remains entrenched and social tension escalates. Gender and governance progress is minimal, and conventional agriculture drives continued deforestation and rural stagnation. When both national and global efforts falter, progress stalls universally, renewables, poverty reduction, inequality, empowerment and rural development all lag, leaving Brazil exposed to persistent climate and social risks.

Scenario 2 | National Too Little Too Late | Global Giant Leap

If only global action accelerates, Brazil sees limited benefits in this scenario. Advances abroad curb emissions and moderate poverty for a time, but without robust domestic reform, inequality persists and rural transformation is weak domestically. Global climate progress brings modest national benefits. However, without ambitious countrywide policies, Brazil will miss transformative opportunities. Absent domestic reform, energy and emissions improvements are limited; poverty reduction plateaus and inequality rebounds following early gains. Empowerment is uneven and favours urban elites; food system emissions persist, with limited rural progress. Without domestic reform, energy transition, poverty reduction and inclusion remain limited and uneven, rural progress stalls and inequality rebounds.

Scenario 3 | National Giant Leap | Global Too Little Too Late

Strong national action, even amid global inertia, can still drive substantial domestic change, dramatically expanding renewables, eradicating poverty, empowering women and regenerating rural economies. Strong national leadership accelerates renewable adoption and emission cuts, nearly eradicating poverty by 2040 and sharply reducing inequality. Women's empowerment and regenerative agriculture build institutional resilience, though global climate action lags. The transformation at the national level is robust but nevertheless limited due to lack of international momentum.

Scenario 4 | National Giant Leap | Global Giant Leap

In the fourth scenario, ambitious domestic and global reform deliver the most profound transformation with deep, resilient change in all areas. Joint national and global leaps create a resilient and inclusive society powered by clean energy because fossil assets are written off, air quality and energy security steadily improve. Poverty and inequality are nearly eliminated before 2040, empowerment broadens rapidly, and food systems become regenerative. The regenerative rural economy sustains long-term human wellbeing and ecological resilience. This scenario combines ambitious national and global transformations, yielding rapid decarbonisation, inclusive prosperity, deep reductions in inequality and resilient, empowered societies, demonstrating that synchronised action at both levels is essential for lasting results.

Figure 5: Overview of the modelling results

SCENARIO	One	Two	Three	Four
Turnaround	**National Too Little Too Late** **Global Too Little Too Late**	**National Too Little Too Late** **Global Giant Leap**	**National Giant Leap** **Global Too Little Too Late**	**National Giant Leap** **Global Giant Leap**
POVERTY	Poverty declines until the early 2030s, then rises again after 2040 as productivity slows and inequality widens. Climate shocks keep rural and peri-urban vulnerability high.	Poverty decline continues past the 2030s owing to favourable global markets but stabilises mid-century. Without domestic redistribution, the benefits of global growth do not reach low-income groups.	Poverty falls steeply through the 2030s and nears eradication around 2040. Rising incomes and stronger cohesion prevent major reversals despite slower growth later.	Poverty almost disappears before 2040 and stays very low. Reinforcing gains in income, wellbeing and governance resilience sustain a virtuous cycle against new shocks.
INEQUALITY	High and persistent inequality with only a temporary easing in the mid-2020s. Social tension and elite capture intensify after 2040.	Slight decline in inequality to mid-2030s, then a slow rebound. Weak domestic redistribution limits trust recovery and cohesion.	Sharp fall in inequality through 2040, followed by stabilisation at moderate levels. Trust in institutions strengthens and tension subsides.	Deep and lasting reduction in inequality. Labour share of GDP rises steadily, social cohesion strengthens, and the governance–trust loop turns strongly virtuous.
EMPOWERMENT	Gender parity shows little progress. Women's representation and pay gaps change minimally, leaving governance quality stagnant.	Slow, uneven improvement in gender representation by mid-century; empowerment advances mostly among urban elites.	Noticeable increase in women's leadership and wage parity during the 2030s–2040s, improving institutional capacity and inclusion.	Rapid, broad empowerment. Gender balance across sectors supports resilient institutions and reinforces social trust and collective efficacy.
FOOD	Conventional agriculture expands until 2040, keeping emissions from land-use change positive. Deforestation persists and rural incomes stagnate.	Land conversion slows slightly as global demand eases, but agricultural emissions remain high and forest regeneration limited.	Deforestation falls sharply after 2030. Secondary vegetation and regenerative agriculture expand. Rural incomes rise in the 2030s, then level off as land limits are reached.	Forest loss stops early and net land-use emissions turn negative before 2050. Regeneration and sustainable farming dominate, rural incomes stay high, and ecosystem resilience strengthens.
ENERGY	Renewable electricity stays around three-quarters of supply through the 2030s, rising only slowly thereafter. Emissions from power peak mid-2030s and fall modestly, keeping fossil generation present. Stranded-asset losses remain limited but delayed.	Global decarbonisation weakens fossil demand abroad, moderating domestic emissions somewhat. Renewables rise gradually toward the 2040s but still below full substitution. Refining capacity begins to idle late in the period, creating moderate stranded-asset losses.	Domestic investment and lower fossil ROI accelerate the shift after 2030. Renewables exceed 90% by 2050, power-sector emissions fall sharply, and stranded assets peak early then stabilise.	The most rapid transition: near-total renewables by 2050, rapid decline of fossil output, early write-off of fossil assets, and steady improvement in air quality and energy security.

Integrating the five extraordinary turnarounds and their cross-cutting dynamics

Across all the scenarios, Brazil's long-term trajectories are shaped by the same underlying forces. The simulations show that progress or stagnation is not a result of the sudden appearance of new factors, but rather from the ways in which relationships between existing variables are steered. Put simply, the system behaves like a network of brakes and engines, self-correcting and self-reinforcing processes that can either stabilise at the status quo or accelerate positive change (see Figure 6).

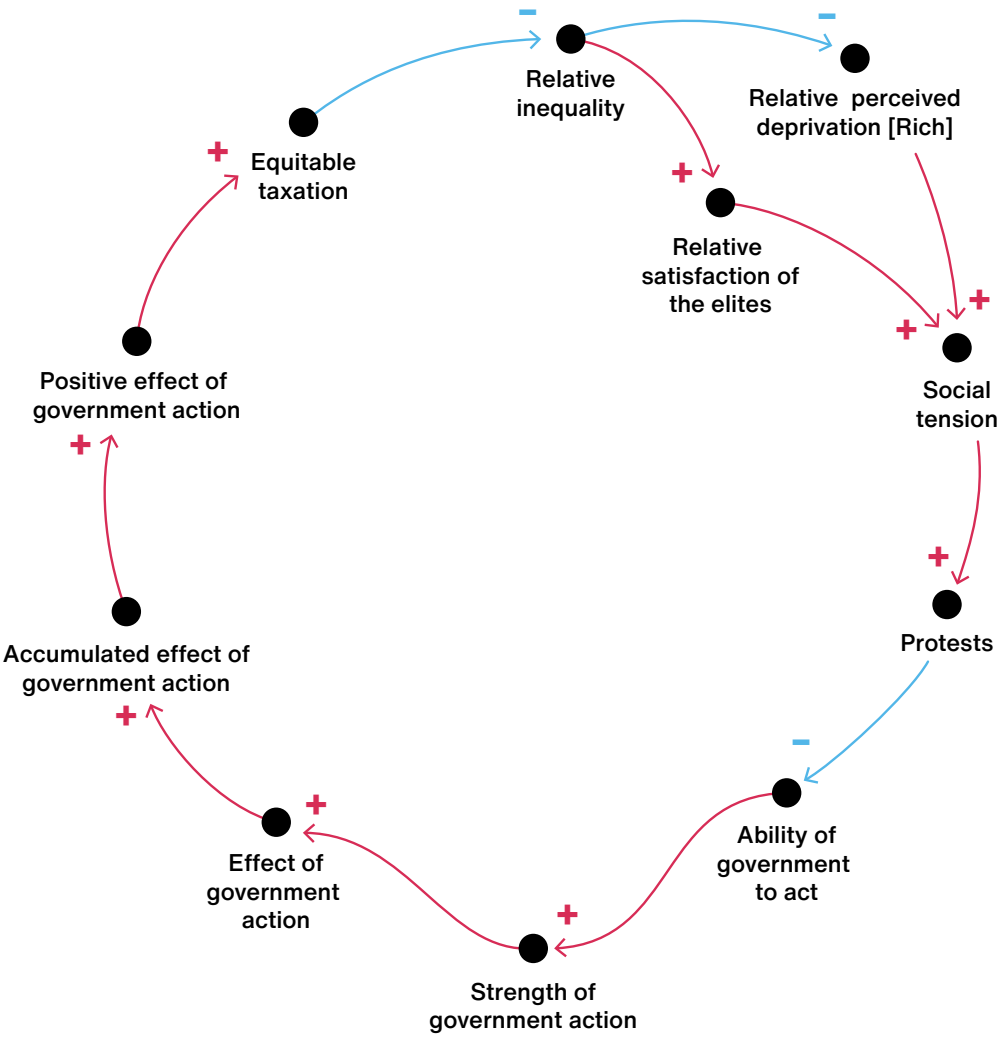
Brakes (balancing forces) act to restore balance when society moves too fast or when reforms are perceived as threatening. For example, when wealthier interest groups feel they are losing ground, political pressure builds and government capacity weakens. Environmental and market pressures also push back when resource use becomes excessive. These forces are essential for stability, but their "target" can be shifted: instead of protecting old privileges or unsustainable practices, they can be redirected to safeguard social inclusion and ecological resilience.

Engines (reinforcing forces) amplify progress or decline once it begins. When people see that social policies are effective and inequality is falling, trust grows, cooperation increases and the government gains room to act further. When positive tipping points are crossed, these forces can turn a moment of improvement into a sustained transformation, but only if institutions remain credible and policies predictable. The same logic applies to capital. If regenerative activities are rewarded, they will prevail. Otherwise, extractive activities will continue to grow, and this growth will reinforce itself by crossing negative tipping points.

Two of the key feedback mechanisms that emerge as dominant across the four scenarios relate to the perceptions and the Brazilian elites and interest groups (see Figure 6). One of them is a balancing force related to the regulation of the perception of these elites in terms of their material deprivation and the country's inequality and related policy action. The other refers to the self-acceleration of social tensions as privilege (or elite satisfaction, as defined in the social tension measurement literature) is perceived by the overall population.[12] An emerging policy insight is that transformation depends on governing feedbacks. That is, steering stabilising forces toward the right goals and ensuring that the drivers of change remain fair, inclusive and socially supported.

[12] See Bich, P., Chateauneuf, A., & Ventura, C. (2023). Social tension order: A new approach to inequality reduction. *Journal of Mathematical Economics, 108*, 102886.

Figure 6. Balancing forces and reinforcing forces in Brazil



Taken together, the five turnarounds show that Brazil's transformation potential is not limited narrowly by technology or finance, but rather by coordination and perception. The Giant Leap scenarios demonstrate that when social inclusion, empowerment and environmental restoration advance together, they are mutually reinforcing. Poverty and inequality fall as renewable energy expands and regenerative agriculture strengthens rural livelihoods. Empowerment of women and vulnerable groups enhances institutional quality, which in turn enables more consistent and equitable policy action.

Sustainable prosperity therefore depends on linking these agendas rather than pursuing them separately. Aligning the goals of social policy, economic reform and environmental protection within a credible long-term vision can transform Brazil's natural stabilising tendencies into a source of resilience and shared progress. The Giant Leap is thus not a single policy package, but a coordinated way of steering the country's feedbacks toward wellbeing, equity and planetary balance.

4. Policy implications

Poverty

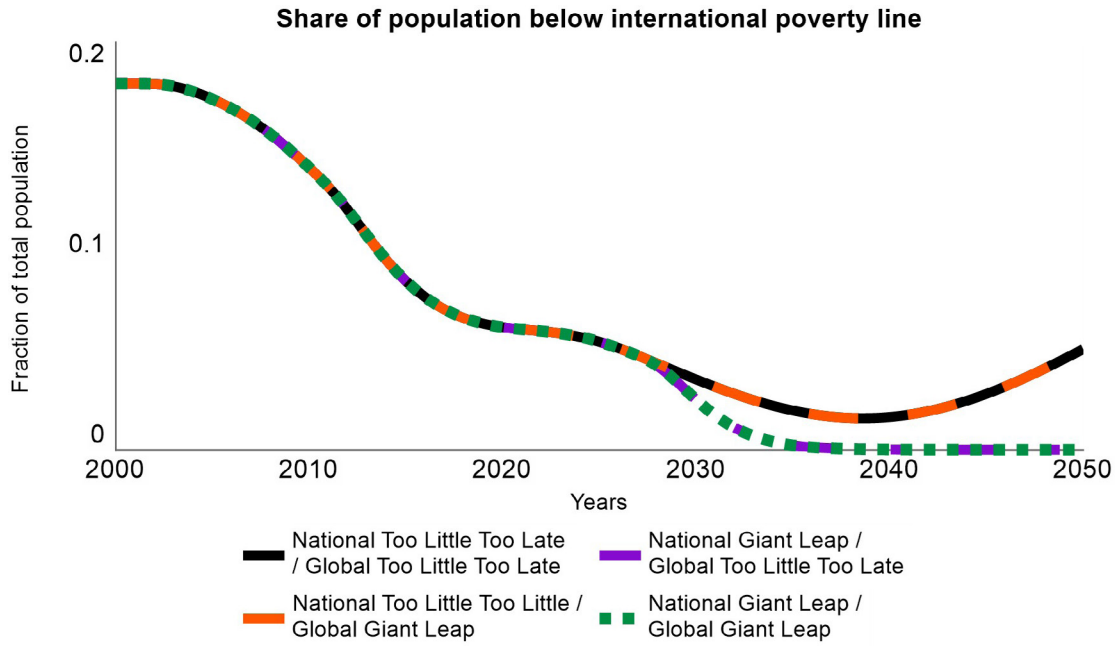
Brazil's climate-poverty nexus in 2025 is defined by deep inequality, persistent poverty and mounting climate risks. On the one hand, over 6.5 million families have recently risen above the poverty line thanks to Bolsa Família, improved labour conditions and economic recovery.[13] On the other, around 20% of Brazilians still live below the upper middle-income poverty line.[14] The climate crisis amplifies these vulnerabilities by undermining agricultural livelihoods, escalating health risks and driving rural displacement, disproportionately affecting Indigenous and marginalised communities. Despite promising advances in social policy, Brazil's core challenge remains achieving sustainable, inclusive and climate-resilient development.

In recent years, Brazil has begun aligning social protection and climate policy through initiatives such as the Ecological Transformation Plan.[15] The Ecological Transformation Plan integrates decarbonisation, industrial policy, bioeconomy and just transition goals. At the same time, programs such as Bolsa Verde and Pronaf connect poverty reduction to conservation and low-carbon agriculture.[16] Yet Brazil's path toward a cohesive poverty-climate strategy faces significant fiscal, institutional and political constraints.[17] Challenges include limited funding for resilience infrastructure, policy incoherence and powerful fossil fuel and agribusiness lobbies. Weak enforcement of environmental laws, persistent corruption, high levels of organised crime and social distrust further hinder progress. Without deeper reforms and sustained inclusion of vulnerable groups, Brazil risks missing its 2030 goals and undermining both climate and social justice objectives.

Brazilian poverty rates decline in all scenarios through the early 2030s, but diverge afterwards (see Figure 7). Under the Too Little Too Late scenario, the decline stalls and reverses after 2040 as inequality widens and productivity slows. A purely Global Giant Leap scenario fails to eradicate poverty because domestic redistribution remains weak. In the National Giant Leap and Global Giant Leap scenario, poverty falls steeply during the 2030s and is nearly eradicated by 2040. The Giant Leap scenario on global and national level show that rising income, stronger social protection and greater social cohesion sustain improvements even as economic growth plateaus later in the period. Meanwhile, rural incomes rise sharply under the Global Giant Leap and National Giant Leap scenarios, reflecting the combined effect of smallholder support, higher agricultural productivity, and redistributive policies that strengthen rural demand and economic wellbeing.

[13] See https://agenciabrasil.ebc.com.br/en/economia/noticia/2025-09/over-65-million-brazilian-families-left-poverty-two-years
[14] See https://documents1.worldbank.org/curated/en/099516404212531759/pdf/IDU-219d2fbb-9fdf-4efb-8504-5addb6c841fd.pdf
[15] See https://www.gov.br/fazenda/pt-br/acesso-a-informacao/acoes-e-programas/transformacao-ecologica/novo-brasil-ecological-transformation-plan/0723_pte_digital.pdf
[16] See https://pmc.ncbi.nlm.nih.gov/articles/PMC12013619/
[17] See https://carnegieendowment.org/research/2024/07/political-barriers-to-decarbonization-in-brazil-the-persistence-of-neoliberalism?lang=en

Figure 7. Scenarios of changes in population below the international poverty line (2000-2050)



The Earth4All modelling and research finds that Brazil can only eradicate poverty durably if delivery is fast, fair and visible. Measures must link climate action - on mitigation and adaptation - to everyday gains so that trust grows and polarisation recedes. As noted below, a community-governed climate-poverty sovereign wealth fund, capitalised by green bonds, carbon revenues and redirected fossil subsidies can transparently finance resilient infrastructure, social protection and ecosystem restoration where needs are greatest. To sustain momentum, strengthen participatory governance and use systems-based coordination across ministries, Indigenous groups, civil society and business to align policies, budgets and metrics.

Scale up delivery to build social trust: Social trust starts with concrete steps to ensure effective and inclusive delivery of Brazil's climate-poverty commitments. This lays the foundation for empowering communities and fostering collective ownership of Brazil's transformed future. While the Ecological Transformation Plan shows progress, Brazil can strengthen trust by expanding commitments that deliver tangible improvements in people's lives, bridge inequality gaps, amplify marginalised voices, address power imbalances and tackle corruption. When citizens see the government eradicating poverty, reducing inequalities, protecting Indigenous rights and integrating social protection with climate action, legitimacy and social cohesion grow.

Create a climate-poverty sovereign wealth fund with community governance: Brazil could establish a climate-poverty sovereign wealth fund with direct governance participation by Indigenous peoples and marginalised communities. The fund would be capitalised through green bonds, carbon market revenues and redirected fossil fuel subsidies. The fund would prioritise long-term investments in climate-resilient infrastructure, social protection and ecosystem restoration, with governance participation from Indigenous peoples, racialised groups and vulnerable communities. This represents a novel legal-financial innovation that would channel resources transparently to marginalised voices, linking climate and poverty goals through participatory budgeting and local decision-making. This is especially relevant given Bolsa Família budget cuts and limited Pronaf funding.

Strengthen participatory governance innovations: Enhance participatory mechanisms such as Conselhos de Politicas Sociais and ensure transparency in Bolsa Família and Ecological Transformation Plan outcomes. Visible progress in poverty reduction, forest protection, climate action and equality will anchor the ecological transition's credibility. Earth4All's systems thinking expertise can improve coordination across multi-level governance and sectors, ensuring diverse voices shape transformation policies. Earth4All can also counter polarisation and denialism by fostering deliberative dialogue platforms and digital tools that build trust and collaborative decision-making. This strengthens the foundation for sustainable, equitable poverty reduction and ecological transformation, linking citizen engagement to policy change and climate justice.

Deepen Brazil's climate and poverty efforts through systemic approaches: Earth4All can amplify Brazil's Ecological Transformation Plan through integrated, multi-dimensional systems thinking at strategic and operational levels. This reinforces environmental integrity with social and economic progress. Earth4All can provide ongoing systems-based modelling and scenario analysis to support decision-making, integrating feedback loops and cross-sector effects. Earth4All can also facilitate cross-sector platforms that unite government ministries, Indigenous groups, civil society and private sector actors for cohesive planning and implementation.

Inequality

Brazil remains one of the world's most unequal large economies, with the richest 1% earning about 27.4% of national income, the top 0.1% holding over 12%, and the top 10% controlling roughly 78% of wealth, while many adults carry little or negative net assets. Despite these disparities, progress has been visible. In 2024, Brazil's income Gini coefficient fell to 0.506, the lowest since the Pesquisa Nacional por Amostra de Domicílios (Brazil's National Household Sample Survey of socioeconomic data) series began in 2012, supported by labour-market recovery, wage growth and redesigned conditional cash transfers.[18] Despite this, persistent inequality undermines climate resilience and social cohesion, limiting low-income and marginalised groups' ability to invest in adaptation, build savings or participate in the low-carbon transition.

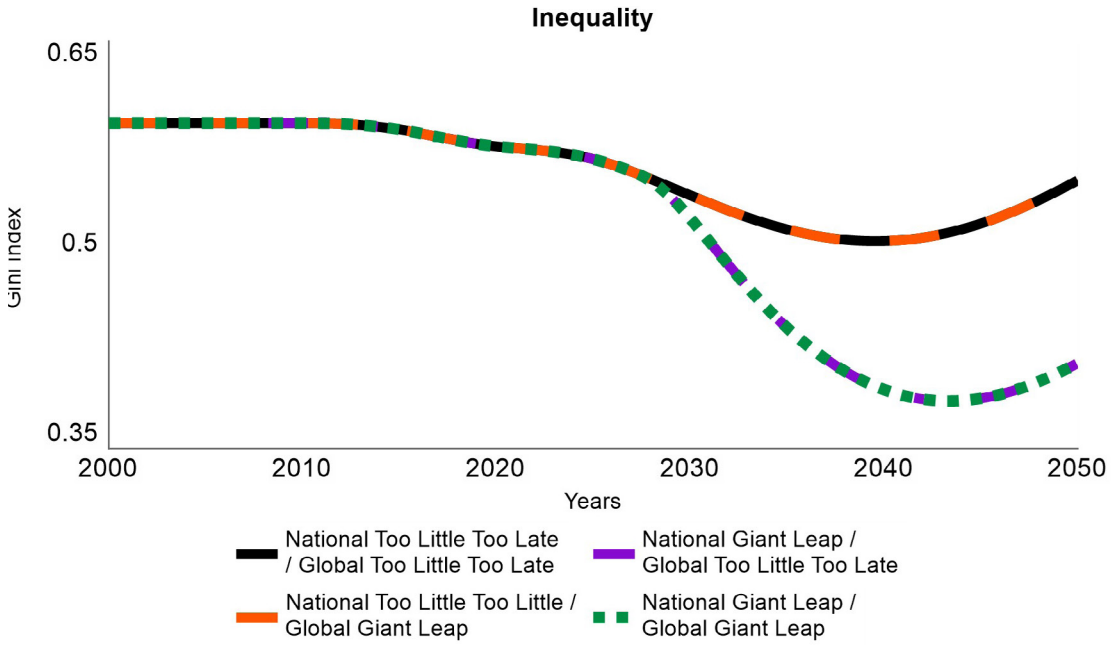
Brazil has expanded its social, fiscal and environmental policy responses to bridge inequality and climate goals. The Ecological Transformation Plan outlines decarbonisation pathways linked to productivity and green jobs, supported by measures such as Law 14.611/2023 on pay equity, Bolsa Família expansion, Desenrola's debt relief and the Pe-de-Meia program with a graduation savings bonus for low-income students.[19] Fiscal modernisation includes tax-base reform, higher exemptions for low earners, adjustments to Interest on New Equity payments and proposed minimum income tax on the wealthiest, including dividends.[20] By narrowing pay gaps and boosting earnings for the bottom, Brazil is strengthening household savings and access to credit for energy-efficient upgrades and climate adaptation. It is also recognising that reducing inequality is itself a critical climate policy that enhances the durability of the green transformation.

Despite progress, deep-seated obstacles persist. Fiscal complexity, political resistance, and elite capture constrain wealth and ecological tax reform. Attempts to increase taxes on the super-rich, via higher dividend and financial transaction taxes, have faced pushback in Congress and legal challenges. Brazil's tax system remains highly regressive, with the wealthiest 1% paying proportionally less than average citizens.[21] Broader challenges include institutional fragmentation, persistent polarisation, and also the

[18] It has crept up marginally in 2025, however. See https://agenciagov.ebc.com.br/noticias/202505/desigualdade-cai-ao-menor-nivel-desde-2012-indica-ibge
[19] https://www.payanalytics.com/resources/articles/brazil-equal-pay-law-requirements-reporting
[20] See https://apnews.com/article/brazil-income-tax-economy-b20ecfb63275deaef5b3303aae2cdd74
[21] See https://valorinternational.globo.com/economy/news/2025/04/25/middle-brackets-of-the-wealthy-will-pay-lions-share-of-tax-increase.ghtml

growth of organised and environmental crime, all of which weaken the transition toward a wellbeing economy. Furthermore, limited investment in care infrastructure in flood- and heat-prone regions constrains women's economic participation, while underfunded adaptation and social protection systems restrict the capacity to protect the most climate-exposed communities.

Figure 8. Scenarios of changes in inequality (Gini) between 2000-2050

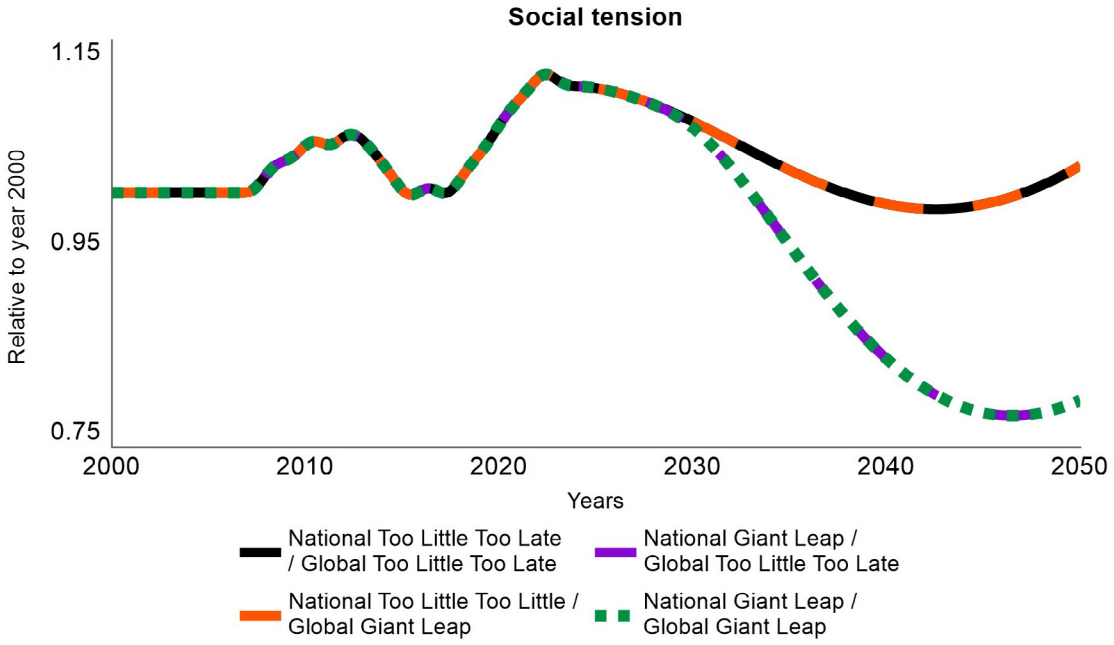


Despite new domestic policy, Brazilian inequality remains high and persistent (see Figure 8). Under both the Global Too Little Too Late and Giant Leap scenarios, it declines only slightly to the mid-2030s before rising again after 2040 due to lacking domestic action. Whereas combination of the National Giant Leap and Global Giant Leap scenarios deliver a deeper and lasting reduction: as the labour share of GDP rises steadily, social cohesion improves and trust in institutions grows. This outcome reflects the combined effect of redistributive taxation, higher social transfers, and inclusive employment policies supported by stronger governance capacity.

Meanwhile, the modelling finds that social tension in all scenarios fluctuates slightly until 2030, then declines dramatically in the Global Giant Leap and National Giant Leap scenario and in the Global Too Little Too Late and National Giant Leap scenario (see Figure 9).[24] On the other hand, in the Global Giant Leap and National Too Little Too Late scenario social tensions begin to rise again after 2040. Structurally, social tension is driven by inequality, wellbeing and institutional capacity, with feedbacks from trust and social capital. This shows compelling evidence that with the Giant Leap scenarios both at the global and national levels inequality declines, economic wellbeing improves and the recovery of trust weakens the reinforcing loop that fuels tension. Whereas, in the scenario of the Global Giant Leap and National Too Little To Late, persistent inequality and weaker governance keep the balancing feedbacks from activating fully, leading to stagnation and eventual reversal of progress.

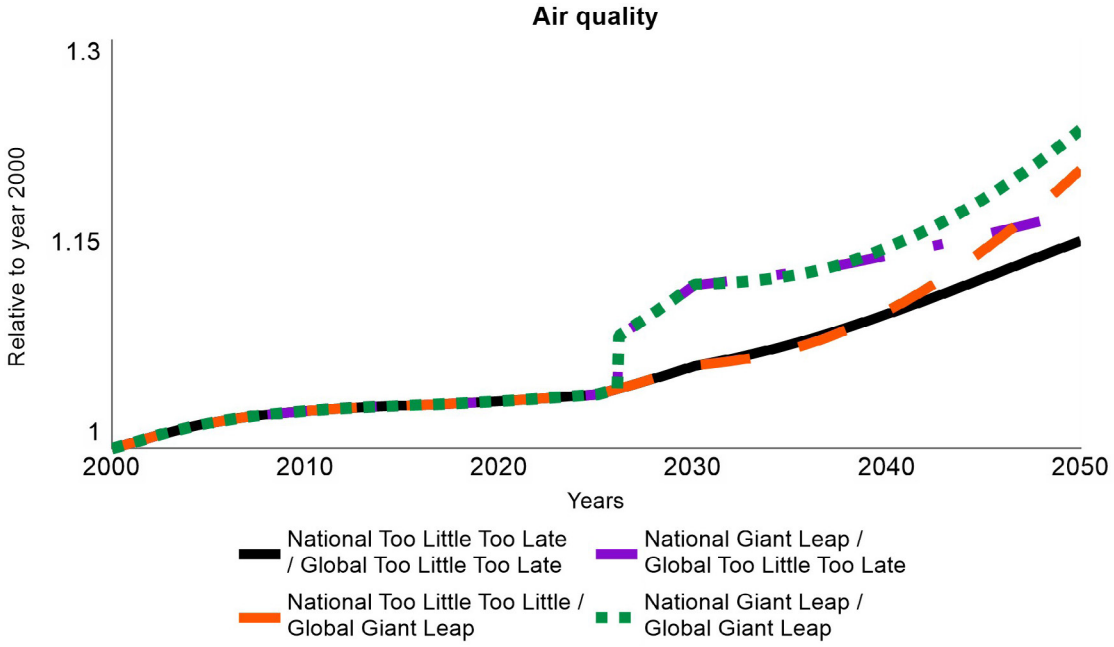
[24] The concept of social tension is dynamically operationalised in the model in accordance with an emerging body of literature that includes guidelines on measurement by Bich et al., 2023 and Lee & Shin, 2015. It is computed from intragroup cohesion (proxied by the group grievance component of the Fragile States Index) and from three inequality-related dimensions that are described in this specific body of literature: satisfaction of the elites, perceived deprivation and between-group alienation. The last two are computed differently for rich and non-rich social groups in accordance with the definitions in specialised literature. Historical data to test the social tension variable is drawn from the World Governance Indicators of the World Bank, specifically the inverse of the normalised political stability and absence of violence dimension, which is in itself a composite indicator. The political polarisation score (v2cacamps) from V-DEM has been employed during the model testing phase but has not been selected as a proxy for social tension in this version of the Brazilian model.

Figure 9. Scenarios of changes in social tension between 2000-2050



In addition to the relationship between inequality and social tension, it is also important to point out the correlation between inequality and direct/indirect health impacts related to climate related dynamics. While most of the attention is directed to emissions of greenhouse gases, local pollutants affect the daily lives of Brazilians, potentially revealing privileges in access to high quality air and water. In the case of air quality, the model considers forest fires and fossil fuel use in electricity and in transport.[25] The simulations show that while the national policy measures make more difference in the short term, the global context will determine much of the future trends in air quality (see Figure 10).

Figure 10. Scenarios of changes in air quality between 2000-2050



[25] The representation of air quality in the model is limited to three weighted divisors: forest fires, emissions from fossil electricity generation and emissions from transport, which are represented in a very limited way given that the model does not contain a transport or mobility sub-module.

Develop strategies for increasing the progressivity of the tax system: Brazil can cut inequality by designing a more progressive tax system and channelling revenues from wealth and ecological contributions into visible social protection and climate investment. A unifying national plan should frame these reforms as shared prosperity, with transparent, data-tracked spending that strengthens safety nets and climate resilience. Internationally, a Global South–style tax hub can close loopholes, harmonise fair rules and steer credits to measurable social and ecological outcomes. Pairing this fairness agenda with a national push on air quality would enhance quality of life directly - including real-time monitoring, neighbourhood health reporting, cleaner buses and fuels, industrial controls and heat and fire prevention - so reforms deliver benefits people can see and breathe.

Earth4All recommends several policy interventions to support Brazil in increasing the progressivity of its tax system. They include: wealth and ecological contribution taxes earmarked for social protection and climate; pilot local progressive property and land taxes; digital tools for tax transparency and citizen engagement; participatory budgeting to enable marginalised groups to engage in the co-creation of fiscal policies and the development of a unified national transformation plan with constitutional or participatory weight, instead of its current sectoral approach targeting specific investments.

Explore options for overcoming challenges to wealth taxation: Brazil has initiated a wide range of fiscal reform efforts aiming to increase withholding taxation on financial investments, dividends and Interest on Net Equity payments, all of which would target the wealthy more effectively.[26] Nevertheless, significant political and legislative challenges remain with the capture by vested elite interests. It is important to frame wealth tax reform as a unifying, progressive tool that links climate action with social equity, backed by transparent budgeting and tangible, data-driven benefits. Framing a new narrative that positions wealth tax revenues as a catalyst for reducing inequality, poverty and ecological vulnerability, supported by case studies and data addressing fears of economic harm.

Accelerate transparent reform design with participatory budgeting: Participatory budgeting creates a strong foundation for citizen oversight to bolster legitimacy and to work towards legally dedicating wealth tax revenues to integrated social protection and climate adaptation funds to demonstrate visible improvements in human and ecological wellbeing.

Stand-up a Global South tax cooperation hub: A Brazil-led Global South tax cooperation hub could help to unite countries in Most of the World through the sharing of expertise, closing of loopholes and the advancing of fairer tax systems, including credits tied to measurable social and ecological progress.

Launch a task force on climate, air quality and health in Brazil: Brazil could create a national, time-bound task force to expand the science and public awareness of how climate impacts and pollution affects air quality, health and wellbeing in Brazil, and to translate that knowledge into fast, fair action. The task force would convene national and state environmental agencies, National Institute for Space Research (INPE), National Institute of Meteorology, Fiocruz and university public-health schools, Brazilian Institute of Geography and Statistics (IBGE), Indigenous and Afro-descendent representatives, professional societies and private-sector partners, alongside international agency observers from the World Health Organization and Pan American Health Organization to align with global standards and growing knowledge around the interface between health and climate.

[26] https://www.grantthornton.com.br/insights/artigos-e-publicacoes/international-tax-newsletter-maio-2025/

Empowerment

Empowerment and climate resilience in Brazil are tightly linked, with the climate crisis intensifying gender, race and class inequities. Vulnerable groups, particularly Afro-descendent and Indigenous communities, rural women and urban marginalised populations, face amplified risks from heat, floods, droughts and displacement. Likewise, high femicide rates and precarious work arrangements constrain women's participation in public life and economic security.

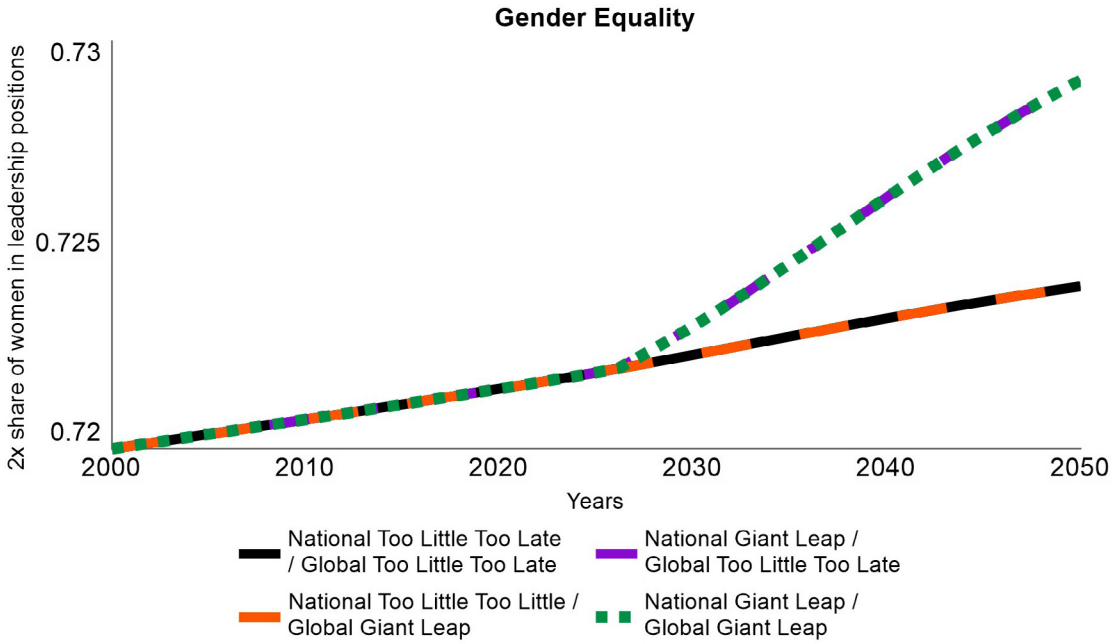
Brazil has made significant institutional and legislative advances to close gender gaps and integrate empowerment into its climate and development strategies.[27] Examples include the creation of the Ministry of Women, restoration of budgetary autonomy and embedding gender equality in the 2024–2027 Pluriannual Plan, with equal-pay laws such as Law 14.611/2023 and Decree 11.795/2023 driving pay transparency for firms with over 100 employees and treating discrimination as a corporate risk.

Additionally, the National Plan for Equal Pay and enhanced gender-data infrastructure through Observatório Brasil da Igualdade de Gênero strengthen accountability and social programs like Pé-de-Meia target high-school girls with stipends and graduation bonuses to reduce dropouts.[28,29] Law 14.457/2022 modernises care-work rules, complemented by credit lines for women-led micro, small, and medium enterprises from the Brazilian Development Bank, Caixa, and Banco do Brasil aligned with the Brazilian Sustainable Taxonomy, collectively expanding women's access to education, formal work, capital and leadership to bolster social and climate resilience.[30]

Despite this important progress, implementation hurdles are substantial. Key challenges include a fragmented, conservative Congress; fiscal constraints; and macroeconomic volatility that threaten the funding and scale of reforms.[31] Institutional fragmentation across federal, state and municipal levels undermines policy coherence, while persisting patriarchal and racial norms limit cultural change and civic engagement. The reform landscape is crowded, diluting focus and local capacity, and land-titling efforts for Indigenous and Afro-descendant communities encounter strong opposition from powerful agribusiness interests.[32] These dynamics challenge the steady progress toward a wellbeing-centric, empowerment-climate policy posture across Brazil.

[27] See: https://www.undp.org/sites/g/files/zskgke326/files/2024-06/en_document_cpd_brazil_24-27.pdf
[28] See: https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/12/gender-budgeting-in-brazil_3dab2c98/fa31b226-en.pdf
[29] See: https://www.aspenanalytics.io/brazil-payequity-14-611/
[30] See: https://www.dpc.com.br/new-act-establishes-the-emprega-mulheres-program/?lang=en
[31] See: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/drivers-of-trust-in-public-institutions-in-brazil_55a6fcbf/fb0e1896-en.pdf
[32] See: https://www.hrw.org/world-report/2025/country-chapters/brazil

Figure 11. Scenarios of changes in gender equality (women in leadership positions) between 2000-2050



Gender parity and empowerment advance only slowly in the National Too Little Too Late and Global Giant Leap scenario, and gains remain concentrated among urban elites (see Figure 11). By contrast, in the National Giant Leap and Global Giant Leap scenario, women's leadership rises sharply through the 2030s and 2040s, broadening beyond major cities into public institutions, civil society and the private sector. These advances strengthen governance quality and institutional effectiveness, widen social inclusion and create a virtuous cycle in which empowerment is both a driver and a result of broader progress.

To unlock Brazil's empowerment–climate potential, Earth4All proposes an integrated strategy that combines participatory democracy, fiscal innovation and cultural transformation. Empowerment is not only a matter of social justice, it is a cornerstone of climate resilience and inclusive growth. Evidence shows that when communities have real voice and stake, policies adopt faster, enforcement improves and investments flow to where they deliver the greatest social and ecological returns. While vested interests and structural inequalities can slow change, a coordinated empowerment agenda builds broad coalitions, de-risks implementation and converts climate action into visible gains in health, jobs and trust.

Scale the existing participatory digital democracy platform (Participativo Platform): The existing Participativo Platform has been highly successful in large-scale digital civic engagement. Scaling this platform nationally will help facilitate even broader and more inclusive civic engagement and policy co-creation to build public momentum and create alternative policy channels beyond Congress.[33]

Explore fiscal innovation to promote empowerment: To complement the wide array of innovation financing approaches that Brazil is currently exploring, Earth4All recommends scaling Brazil's social impact bonds with clear, outcome-based metrics that are aligned with empowerment goals. These can be supplemented with new crowdfunding initiatives that provide autonomous funding streams. All of these initiatives will need robust data verification, impact measurements and incentives for investors such as tax benefits. Attracting more private capital towards empowerment outcomes is critical amidst fiscal constraints and macro-economic volatility.[34]

[33] https://www.opengovpartnership.org/brazil-digital-governance-story/

[34] https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2025/07/brazilian-sustainable-debt-market-regulatory-overview-en.pdf%3Frev=146fdbe3f52d4bceb5726e175841377f

Develop multi-level coordination platforms to expand participation: Integrate federal, state and municipal actors with data and capacity-building networks for streamlined implementation and knowledge exchange. Enhanced intergovernmental coordination, increased fiscal space, inclusive governance and robust enforcement mechanisms are vital to overcoming these hurdles and advancing Brazil's social and climate agendas.

Enhance gender-smart resilience where climate impacts hit hardest: This means expanding training vouchers and job-placement programs for women in renewables, regenerative agriculture and resilience services, as well as embedding gender-responsive design into disaster policy. Integrating women's needs into cash transfers, emergency shelters and gender-based violence services, especially in flood- and heat-prone cities, is vital. Brazil's recent climate emergencies have revealed the cost of overlooking gender equity; aligning municipal contingency plans and social registries with gender- and race-sensitive needs assessments can accelerate recovery and ensure that future responses protect and empower vulnerable populations.[35]

Enhance cultural dialogue and advocacy to build awareness and collective action: These are essential to shift norms and ensure that empowerment is institutionalised across Brazil's social and climate agenda. Youth-led storytelling, partnerships with traditional and community leaders and inclusive campaigns can help dismantle entrenched gender and racial biases. Embedding empowerment goals in national adaptation plans, disaster preparedness and sustainable finance systems will secure women's leadership, safety, and economic agency as central to the country's ecological transition.[36] Building an inclusive, gender-smart recovery is not only about fairness, it is a strategic investment in Brazil's resilience, innovation and long-term prosperity.

Food

Brazil remains a cornerstone of global food security and one of the world's most powerful agricultural exporters. Despite geopolitical volatility and recent U.S. tariffs, the country has achieved record grain harvests and robust exports of meat, sugar and coffee. The national supply agency Companhia Nacional de Abastecimento (Conab) estimates a record 2024/25 grains crop – in the 330–400 million ton range depending on the update - driven by soy, corn, rice, beans and cotton.[37] Agribusiness exports set fresh monthly records through 2024–25.[38] These volumes also matter in Brazil's neighbourhood: UN food-security tracking shows conditions improving in Latin America, with Brazil's recent social-policy push helping to reverse post-pandemic setbacks.[39]

[35] See: https://www.onumulheres.org.br/wp-content/uploads/2024/12/G20-Policy-Paper_Final_adjusted.pdf
[36] See: https://www.onumulheres.org.br/wp-content/uploads/2024/12/G20-Policy-Paper_Final_adjusted.pdf
[37] See https://agenciagov.ebc.com.br/noticias/202407/governo-federal-lanca-plano-safra-24-25-com-r-400-59-bilhoes-para-agricultura-empresarial
[38] See https://www.gov.br/conab/pt-br/assuntos/noticias/safra-de-graos-2024-205-e-estimada-pela-conab-em-350-2-milhoes-de-toneladas-e-atinge-novo-recorde-historico
[39] See https://www.gov.br/secom/en/latest-news/2024/07/un-hunger-map-2023-severe-food-insecurity-drops-85-in-brazil and https://www.ifad.org/en/w/news/new-un-climate-crisis-affects-food-security-of-three-in-four-latin-american-and-caribbean-countries

Yet within this success lies persistent domestic food insecurity. Millions of Brazilians struggle to access nutritious diets. Expanding food deserts and food swamps, dominated by ultra-processed foods, have fuelled obesity and diet-related diseases[40] even as undernutrition endures in poorer regions.[41] The cost of healthy diets often exceeds four times that of calorie-dense staples, locking low-income families into unhealthy food patterns. This "double burden of malnutrition" exposes the paradox of a country that feeds the world but fails to ensure universal access to affordable, nutritious food. In addition, farmers who seek to produce real food compete for capital, land workforce and inputs against those producing commodity crops to be exploited for animal feed.

Climate change intensifies these vulnerabilities. Floods, droughts and heat extremes disrupt production and logistics, while deforestation and intensive monocultures (particularly of soy and sugarcane) undermine soil fertility, biodiversity and water security. The result is a fragile equilibrium: Brazil exports record harvests, yet its food system remains ecologically imbalanced and socially unequal. Aligning agricultural policy with climate resilience and social inclusion is essential to correct this imbalance.

Brazil's ABC+ Plan (2020–2030) is in its second phase of low-carbon agriculture, promoting climate-smart practices such as Integrated crop-livestock-forestry systems, biological nitrogen fixation, no-till, efficient irrigation, planted forests and degraded-pasture recovery at scale.[42] Government and research agencies frame ABC+ as both mitigation and adaptation policy. A widely cited briefing puts Brazil's potential emissions cuts at approximately 1.0–1.1 $GtCO_2e$ by 2030 if fully deployed. Additionally, technical assistance and farmer outreach are coordinated through Embrapa's ABC platform and regional services, and Plano Safra 2024/25 reinforces this framework with over R$400 billion for agricultural credit and green facilities for ABC+ practices.[43] Brazil's deforestation-reduction efforts such as the Action Plan for Prevention and Control of Deforestation in the Amazon (PPCDAm) in the Amazon and the Action Plan for Deforestation Prevention and Control of Deforestation and Burning in the Cerrados (PPCerrado) combine command-and-control with land-tenure and credit conditionality, driving a sharp decline in deforestation.[44]

The government's Convergence Initiative and Alimenta Cidades Strategy (2023) represent a new phase of integrated food-climate governance, linking family farming, urban agroecology and territorial markets to national adaptation and mitigation goals. Complementing these, the National Food and Nutrition Security Plan (PLANSAN 2025–2027) promotes agroecology, biodiversity-friendly diversification and restoration of 12 million hectares through agroforestry and no-till systems by the end of 2025.[45] These programs aim to reconnect rural regeneration with urban nutrition equity, ensuring that regenerative agriculture feeds cities sustainably and affordably while engaging Indigenous, quilombola, and traditional communities in decision-making.

[40] Brazil's ultra-processed food diets supply around 20% of calories and is rising. The data on obesity and weight is varied. One study suggests that obesity of over 18s increased from 12 to 26% from 2002-2019 and that over 61% of the adult population was overweight by 2019. Another study found that about 34% of the population is considered overweight and 22% obese. Future trends suggest that obesity could rise to 30% by 2030 and 48% of the population by 2044. See https://agenciadenoticias.ibge.gov.br/en/agencia-news/2184-news-agency/news/29208-one-out-of-every-adults-in-brazil-were-obese-in-2019-and-primary-health-care-was-positively-evaluated, https://www.obesidadebrasil.com.br/post/obesidade-pode-acometer-30-da-popula%C3%A7%C3%A3o-brasileira-em-2030, https://www.worldobesity.org/news/almost-half-of-brazilian-adults-will-be-living-with-obesity-within-20-years

[41] IBGE indicates 72.4% of the households were food secure in 2023 (improvements since 2021) and that declines are expected in 2024. That said, 1 in 4 households still report some level of food insecurity and 6.5 million face severe insecurity. This is highly geographically concentrated in the north and north east, especially among low-income, rural and black and indigenous households. See https://agenciadenoticias.ibge.gov.br/en/agencia-news/2184-news-agency/news/44744-mais-de-dois-milhoes-de-lares-saem-da-inseguranca-alimentar-em-2025, https://agenciadenoticias.ibge.gov.br/en/agencia-news/2184-news-agency/news/39857-food-security-in-brazilian-households-increases-in-2023

[42] The plan emphasises integrating sustainable practices, strengthening governance, monitoring and evaluation, and using a landscape approach to align food security, rural livelihoods, and environmental protection. It also includes measures to restore 30 million hectares of degraded pasturelands by 2030, expand adoption of sustainable technologies and practices across tens of millions of hectares, and achieve greenhouse-gas mitigation gains on the order of 1.1 billion tons CO_2e by 2030. See https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais and https://agenciabrasil.ebc.com.br/en/politica/noticia/2021-10/brazil-expands-carbon-emission-reduction-targets

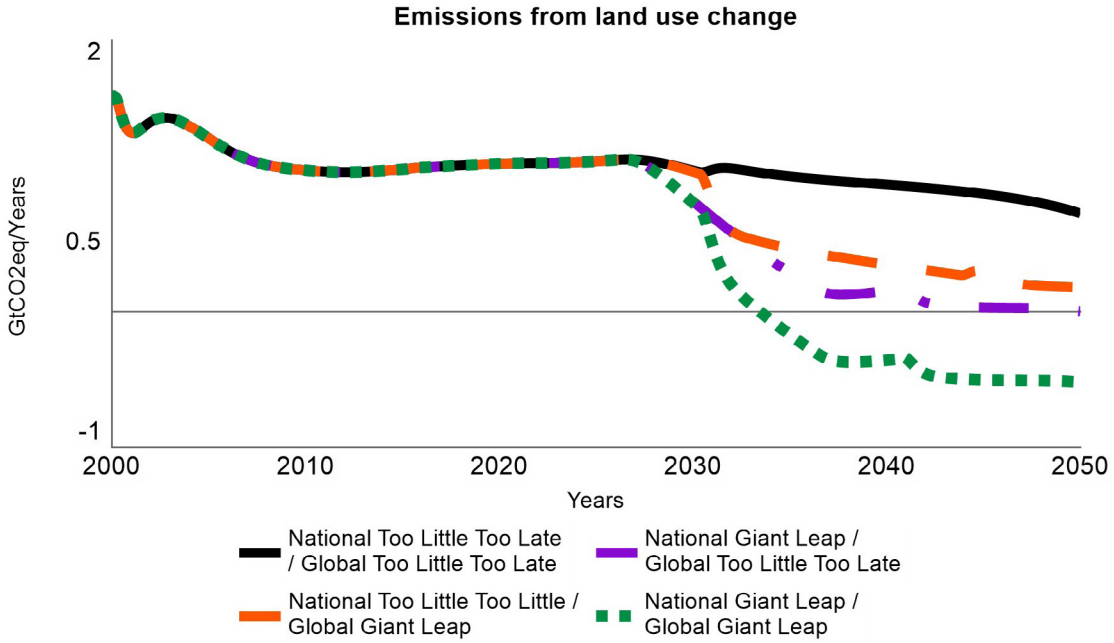
[43] Additional resources of R$108 billion in the Letras de Crédito do Agronegócio (LCAs) bring the total available for agribusiness support to R$ 508,59 billion. See https://www.gov.br/planalto/pt-br/acompanhe-o-planalto/noticias/2024/07/governo-federal-lanca-plano-safra-24-25-com-r-400-59-bilhoes-para-agricultura-empresarial and https://exame.com/agro/plano-safra-24-25-mapa-anuncia-r-40050-bilhoes-para-agricultura-empresarial/

[44] See https://www.gov.br/mma/pt-br/ppcdam_2023_sumario-rev.pdf

[45] See https://semil.sp.gov.br/educacaoambiental/prateleira-ambiental/iii-plano-nacional-de-seguranca-alimentar-e-nutricional-2025-2027/ and https://www.gov.br/secom/pt-br/assuntos/noticias/2025/03/plano-de-seguranca-alimentar-e-nutricional-projeta-que-brasil-saira-do-mapa-da-fome-ate-2026

Key priorities in Brazil's agriculture and ranching sectors now extend beyond traceability, targeting and risk pricing to include adaptive, data-driven systems that link sustainability, inclusion and resilience. And despite Brazil's growing legal and policy framework, implementation challenges remain. These include infrastructural shortcomings, intersectoral coordination complexity, monitoring and enforcement limitations, uneven environmental compliance, climate-induced vulnerabilities, continued preference for subsidies for export-oriented farming and finance gaps.[46]

Figure 12. Scenarios of changes in emissions linked to land use change (2000-2050)



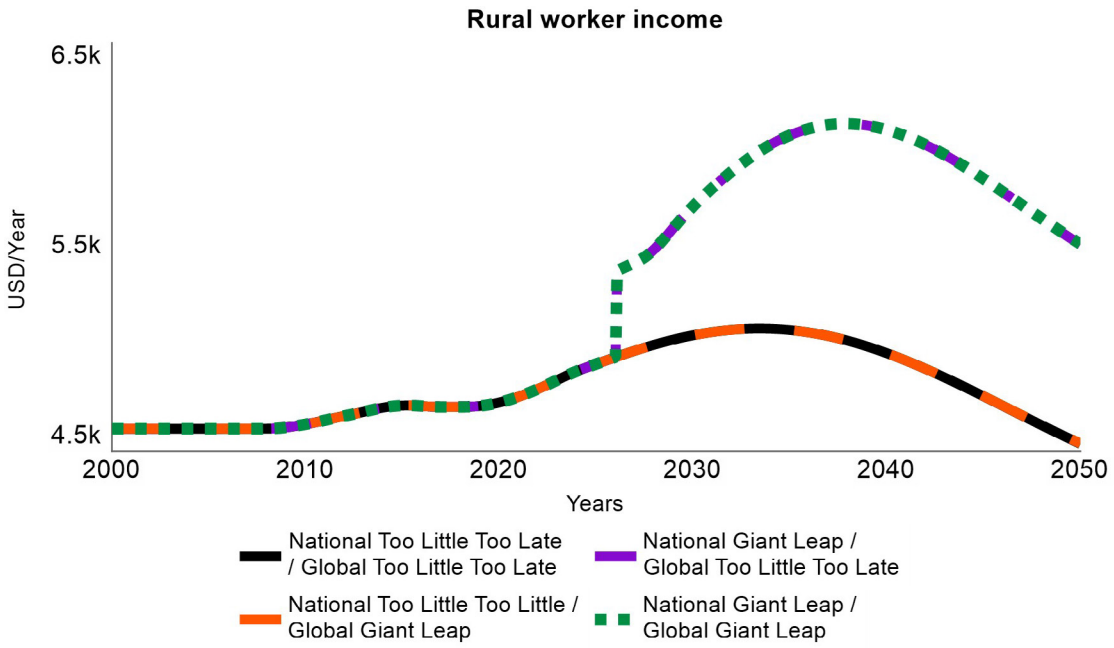
Land-use and agricultural outcomes are among the clearest differentiators between the scenarios (see Figure 12). In the Global and National Too Little Too Late scenario, deforestation continues until 2040, conventional agriculture expands, and emissions from land-use change remain positive. The Global Giant Leap scenario moderates these pressures slightly, but forest regeneration is limited and rural incomes stagnate. Meanwhile, the Global and National Giant Leap scenario brings an early halt to forest loss: deforestation falls sharply after 2030, secondary vegetation and regenerative activities expand, and rural incomes rise before stabilising mid-century. By 2050, land-use emissions turn negative in the Global Giant Leap and approach neutrality in the National Giant Leap scenario, signalling that ecosystem restoration has become a net carbon sink.

After the early 2030s, Earth4All modelling results show that rural worker income rose sharply under the Global Giant Leap and National Giant Leap scenario, peaking around the mid-2030s before slowly declining (see Figure 13). By way of comparison, when the Global Giant Leap is paired with the National Too Little Too Late scenario rural worker incomes do not improve or even fall slightly. The faster and higher rise in the Global and National Giant Leap scenario reflects the combined impact of the Ecological Transformation Plan's income effect, stronger smallholder grants and subsidies and productivity gains from regenerative and sophisticated farming. In the model, regenerative agriculture represents one example of bioeconomic activity.[47] However, many other sectors in the economy (such as chemical, pharmaceutical, packaging, etc.) could benefit from more regenerative production systems. Land dynamics are linked to natural regenerative processes represented in the model. This supports the identification of economic and policy levers that amplify such processes.

[46] https://academia-engelberg.ch/wp-content/uploads/2015/10/brazil_foodsecurity.pdf

[47] See, for example, https://www.wri.org/research/new-economy-brazil-amazon and https://www.iadb.org/en/news/idb-report-shows-potential-bioeconomy-reverse-deforestation-amazonian-region for more on the bioeconomy.

Figure 13. Scenarios of changes in rural worker income (USD/year) from 2000-2050



In contrast, the Global Giant Leap and National Too Little Too Late scenarios lack domestic redistributive and structural-change measures. In both scenarios, the country suffers from stagnating productivity, weak rural policy, and increasing inequality. The complex dynamics involving land grabbing, forest fires and organised crime as captured in the model, can substantially limit progress in these scenarios. Indeed, organised crime can be involved in deforestation directly (by grabbing and clearing land for pasture and crops) and indirectly (by illegally investing into livestock and crop production for money laundering purposes) influencing climatic and inequality pressures both globally and nationally.[48]

In the Global Giant Leap and National Giant Leap scenario, the rise is driven by a reinforcing effect between social policy and productivity: higher transfers and smallholder support raise incomes and demand, which strengthens government capacity and economic wellbeing, enabling further redistribution. The later slowdown reflects the balancing influence of land limits and diminishing returns once rural productivity stabilises. More transformative policy would be needed to prevent this rebound, although the national measures considered already put rural workers in a much better situation by the end of the simulated period. In the Global Giant Leap and National Too Little Too Late scenario, the absence of strong domestic social or rural policies leaves income trends dependent on global market prices and conventional productivity growth, leading to stagnation or decline.

Earth4All recommends an accountability-first food security strategy that aligns finance, data and innovation. This requires that rural credit and tax incentives are conditional on full traceability (especially in relation to beef, soy and timber), that there is Cadastro Ambiental Rural(CAR)/Programa de Regularização Ambiental (PRA) compliance, and PPCDAm/PPCerrado serve as guardrails and embed ABC+ metrics in banking risk models. Recommendations include real-time climate dashboards to flag droughts and fires, the steering of credit to resilient, low-emission practices, and the scaling of producer–consumer digital platforms across urban and rural contexts. Brazil could also stand-up a multi-stakeholder food and agriculture innovation hub to test and spread proven solutions. This might be complemented with innovative finance to direct capital to verified sustainable producers while strengthening environmental integrity and nutrition outcomes.

[48] See, for example, https://www.ft.com/content/f544b82f-c7d3-4112-b557-9234c131b201, https://igarape.org.br/en/the-ecosystem-of-environmental-crime-in-the-amazon-an-analysis-of-illicit-rainforest-economies-in-brazil/, and https://news.mongabay.com/2025/04/brazil-is-speeding-up-forest-fire-prevention-to-avoid-dangerous-tipping-points-in-the-amazon-commentary/

Rural credits and tax credits should be tied to real food production and conditional on traceability: To consolidate progress, credits should incentivise healthy food production. What is more, rural credit and tax incentives should remain conditional on traceability (beef, soy and timber), CAR/PRA compliance, and no-conversion criteria across supply chains, while embedding ABC+ performance metrics in bank risk models. The PPCDAm and PPCerrado plans can act as eligibility guardrails, ensuring concessional finance supports verified sustainable producers and reinforces environmental integrity.

Establish real-time dashboards: These could link environmental, social and economic data for transparent policy monitoring and accountability involving a combination of government actors such as Conab, INPE, Embrapa, financial institutions and other civil society groups through interoperable systems. Dashboards could help map risks, anticipate drought and fire events, and steer credit toward practices with the greatest resilience and emissions benefits, enhancing accountability across public and private actors.[49] Digital platforms connecting producers and consumers are being expanded but Earth4All recommends that they be scaled and tailored to adapt to diverse urban and rural realities.

Create a multi-stakeholder food and agriculture innovation hub: This hub would unite ministries, academia, finance and civil society to institutionalise policy experimentation and continuous learning. The hub would also help to align national objectives with regional realities and feed results into national frameworks for scaling.

Experiment and scale innovative finance instruments: Innovative instruments such as outcome-based payments for land restoration, climate resilience and social inclusion, alongside participatory funding models are essential. It is equally important to maintain rural credit and tax incentives conditioned on traceability for beef, soy and timber, CAR/PRA compliance, and no-conversion criteria across supply chains. Embed ABC+ performance metrics into bank risk models and use PPCDAm and PPCerrado as eligibility guardrails to ensure concessional finance supports verified sustainable producers and environmental integrity.

Energy

Brazil's power system is already among the cleanest in the world. Its early bet on renewables grew from pragmatism. The country's abundant natural resources - rivers for hydropower, strong Northeast winds, high solar irradiance, and a unique bioenergy base made clean electricity and fuels locally available and affordable, while reducing exposure to imported hydrocarbons and global price shocks. That energy-security logic is even stronger today amid geopolitical volatility and geoeconomic shifts that penalise carbon-intensive supply chains and reward clean, reliable power. Expanding wind, solar, storage and advanced biofuels now cushions households and industry against fossil price swings, attracts investment tied to low-carbon production and strengthens grid resilience.

At the same time, a higher share of renewables directly serves Brazil's climate ambition such as cutting power-sector and transport emissions, safeguarding hydrological regimes through complementary sources, and keeping the country on track to meet its Paris targets while growing competitiveness.

The 2024 National Energy Balance shows renewables accounting for roughly 88% of electricity, led by hydro with strong contributions from wind, solar and bioenergy.[50] Solar alone expanded about 40% year over year, pushing total electricity supply up around 5.5%. Regulators recorded a record 10.9 Gigawatts of new capacity in 2024, predominantly wind and solar, while distributed generation continued rising, giving Brazil a notably low-carbon backbone.

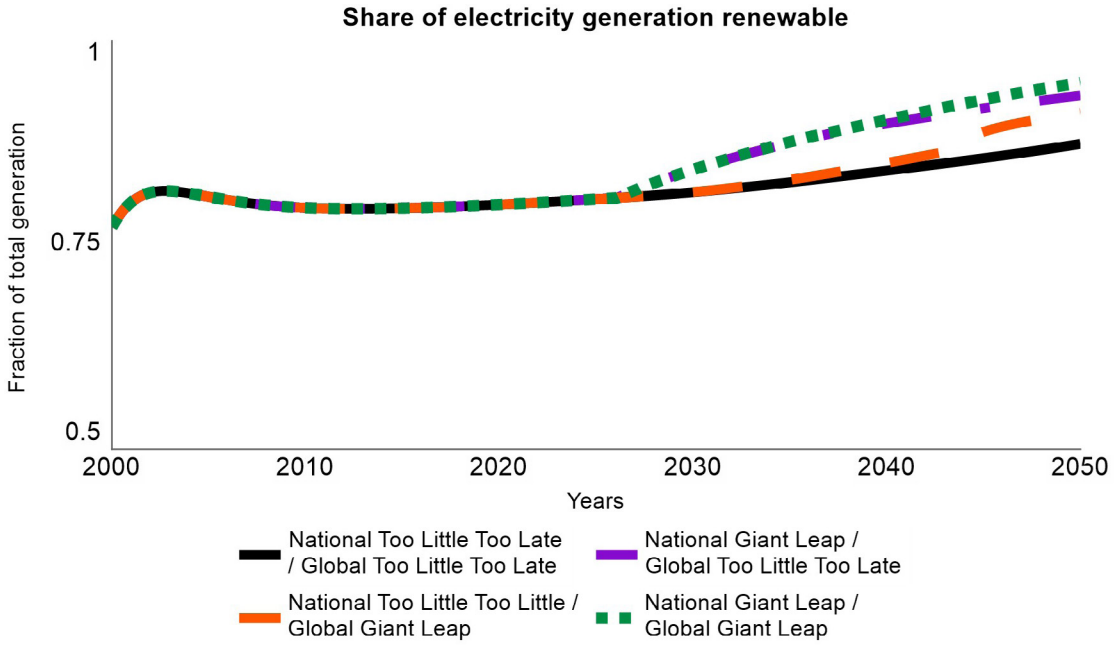
[49] An example of a derisking platform is the Green Bridge Facility's Territorial Risk and Resilience Index which applies a "know your territory" approach. See https://greenbridgefacility.com/. See also https://oglobo.globo.com/blogs/miriam-leitao/post/2025/10/igarape-lanca-plataforma-com-riscos-e-oportunidades-para-quer-investir-em-empreendimentos-verdes.ghtml

[50] See https://www.gov.br/mme/pt-br/assuntos/noticias/brasil-avanca-na-renovabilidade-das-matrizes-em-2024-aponta-balanco-energetico-nacional and https://www.epe.gov.br/en/press-room/news/epe-publishes-the-summary-report-brazilian-energy-balance-2025

Recent reforms further de-risk investment and accelerate decarbonisation: a 2024 law established a regulated carbon market for large emitters,[51] 2025 saw the approval of the Brazilian Sustainable Taxonomy to guide finance toward climate-aligned activities and Eco Invest Brasil provides FX-hedge and liquidity support for long-term green projects. Brazil is also pursuing a National Hydrogen Program to seed green hydrogen value chains and decarbonise hard-to-abate sectors.[52] Despite these advances, grid curtailment in the Northeast and transmission bottlenecks remain challenges, requiring continued grid upgrades and policy signals to maintain momentum toward faster electrification and deeper decarbonisation.

It is very important to mention here that the newly approved Equatorial Margin Drilling Project marks a major strategic push to unlock Brazil's vast offshore oil reserves, offering potential economic gains and energy security. However, this approval poses grave climate and biodiversity risks, given its location near the Amazon River mouth and the Great Amazon Reef System, heightening the vulnerability of one of the world's most delicate marine and coastal ecosystems. Pursuing new fossil fuel frontiers risks undermining Brazil's international climate leadership and could derail national decarbonization commitments.[53]

Figure 14. Scenarios of changes in electricity generation from renewable sources (2000-2050)



Across all scenarios, Brazil's power mix remains largely renewable, but the pace and depth of the transition differ sharply after 2030 (see Figure 14). In the National Too Little Too Late scenario, renewable electricity stays around three-quarters of total generation through the 2030s and grows only modestly thereafter, keeping fossil sources central and delaying emission reductions. Interestingly the Global Giant Leap scenario benefits somewhat from weaker fossil demand abroad and limited international carbon pricing, but still falls short of full substitution. The Global and National Giant Leap scenario shows a decisive acceleration after 2030: renewables surpass 90% of generation by mid-century, power-sector emissions fall rapidly, and fossil assets are written off earlier, improving air quality and energy security. These differences stem from the strength of domestic levers[54] combined with global conditions.

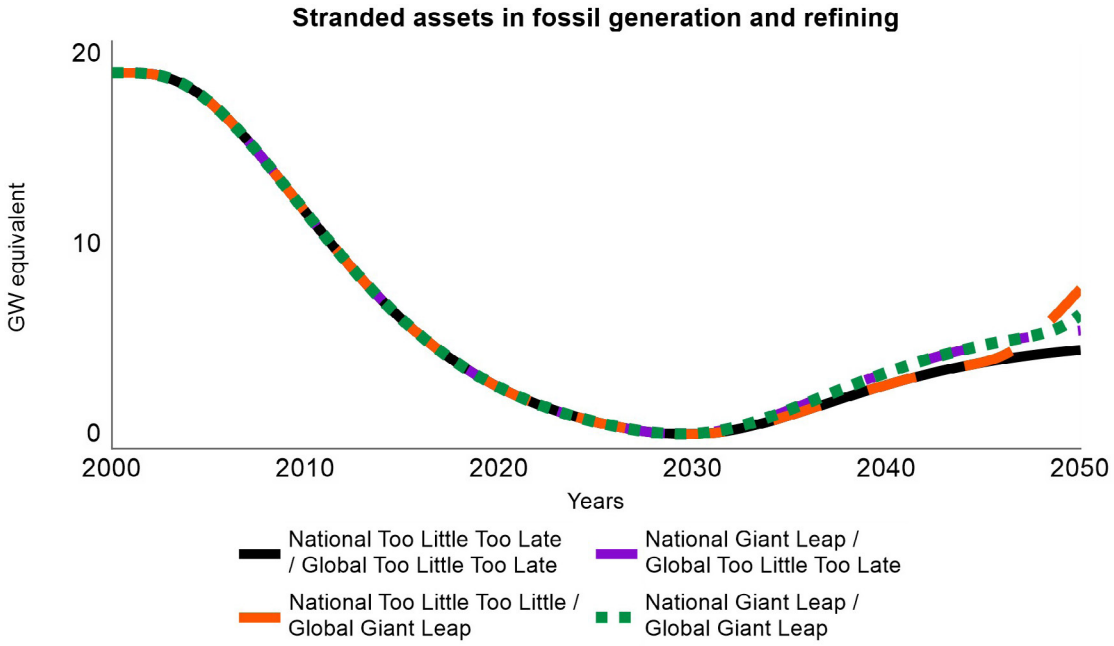
[51] See https://www.planalto.gov.br/ccivil_03/_Ato2023-2026/2024/Lei/L15042.htm

[52] See https://www.gov.br/mme/pt-br/programa-nacional-do-hidrogenio-1

[53] See https://www.spglobal.com/commodity-insights/en/news-research/latest-news/crude-oil/102025-brazils-ibama-grants-petrobras-permit-to-drill-equatorial-margin-exploration-oil-well

[54] For example, renewable investment, fossil disincentives and taxonomy-aligned finance

Figure 15. Scenarios of changes in stranded assets in fossil generation and refining (2000-2050)



After the 2030s, stranded assets rise in all scenarios (see Figure 15). By 2050, stranded assets are highest in the Global Giant Leap scenario, followed by the National Giant Leap, with the Too Little Too Late scenarios the lowest. Most of the late-period strandings are in refining, not power. In power, faster renewable build-out and lower fossil return on investment (ROI) in the Global and National Giant Leap strand thermal generation earlier. The Global Giant Leap strands less due to weaker domestic push, while the Too Little too Late scenario keeps fossil units running longer, postponing write-offs. In refining, higher biofuel blend mandates and slower liquids demand growth create persistent excess refining capacity. As such, the post-2030 resurgence in strandings is dominated by refinery overcapacity, with the largest effect in the Global and National Giant Leap scenario and the smallest in the Global and National Too Little Too Late scenario.

The rise in stranded assets can be explained by biofuel blend expansion and penalties and carbon pricing that erode refinery profitability and trigger write-offs as utilisation falls. The Global Giant Leap imposes a carbon price on fossil energy without Brazil's domestic transition levers, so reinvestment continues longer and then gets written off more abruptly, ending highest. In the National Giant Leap scenario, demand falls faster (higher blends), creating substantial refining overcapacity. The National Giant Leap curbs reinvestment earlier, limiting the stock that can later be stranded. In the Too Little Too Late scenario, slower biofuel growth keeps refineries utilised longer, so fewer assets end up stranded by 2050.

Earth4All proposes a smooth energy transition built on five pillars: fast-tracking transmission; scaling flexible utility-scale storage, demand response, and grid-forming inverters; and creating multi-stakeholder innovation hubs so regulators, operators, communities and investors co-design projects that deliver jobs, fair tariffs and local resilience. Brazil should also future-proof the grid against heat, floods and drought by expanding storage, digital automation and grid-hardening while updating regulations to incentivise new technologies. Finally, a transparent, predictable pipeline will cut curtailment, lower costs, and solidify Brazil's leadership in clean energy deployment.

Fast track transmission expansion: Achieving leadership in the global clean energy race for Brazil this will require fast-tracking transmission expansion to move Northeast wind-and-solar to Southeast load centres, grid-storage markets, and demand-response programs, supported by Eco Invest Brasil and the Brazil Climate and Ecological Transformation Investment Platform (BIP) to crowd in private capital. These upgrades reduce costly curtailment, enable new renewables, and support equitable access to clean power in both urban and remote regions.[55]

Support variable generation: As wind and solar grow, Brazil must scale flexibility including utility-scale storage, demand response and grid-forming inverters so the system can absorb more variable generation. New investment in cutting-edge grid technology will be essential to enable the energy system to absorb a higher share of renewables, stabilise supply and reduce the need for fossil fuel backup.[56]

Invest in innovation hubs: The establishment of multi-stakeholder innovation hubs can coordinate planning between regulators, operators and communities, ensuring that new infrastructure delivers tangible social benefits such as jobs, affordable tariffs and resilience upgrades.[57] These hubs can accelerate job creation, promote affordable tariffs and fossil fuel subsidy re-direction and foster tailored solutions that boost local resilience and ensure the benefits of energy transition are broadly shared.

Future proof the energy grid: Brazil needs to future proof its grid against floods, heat and drought. Brazil already has the machinery such as auctions and concession frameworks to deliver lines and services at scale.[58] Brazil should also expand large-scale energy storage and invest in advanced digital solutions and grid automation to bolster resilience and operational flexibility. This will strengthen reliability, minimise disruptions and ensure that increasing renewable penetration does not compromise the security of energy supply.[59] As well, reforming regulatory frameworks are needed to incentivise innovative technologies. Hence by combining infrastructure upgrades with technological innovation and smart policy, Brazil can ensure the resilience of its clean energy future.[60]

Speed-up the renewable auction schedule, licensing and permitting: Meeting demand will require sustaining a rapid auction schedule and ensuring a transparent, predictable interconnection pipeline with less friction for licensing and permitting. A rapid auction schedule refers to Brazil regularly holding government-led energy auctions thereby allowing renewable energy and grid infrastructure to be competitively bid and awarded. Ultimately, a rapid and well-managed auction schedule lays the foundation for Brazil to become a global leader in renewable energy deployment and an export model for just energy transitions.[61]

[55] See https://www.cleanbridge.co/insights/energy-transition/cleanbridge-global-power-transmission-2025/regional-market-overviews-gpt2025/brazil-gpt2025/
[56] See https://www.rystadenergy.com/insights/latam-energy-corner-curtailment-poses-a-new-risk-for-renewables-in-brazil
[57] See https://www.ainvest.com/news/engie-strategic-expansion-brazil-energy-transmission-infrastructure-catalyst-renewable-integration-long-term-growth-2507/
[58] See https://dadosabertos.aneel.gov.br/dataset/resultado-de-leiloes
[59] See https://reglobal.org/brazils-transmission-outlook-strategic-plan-for-expanding-grid-over-next-decade/
[60] See https://www.pvknowhow.com/news/brazil-renewable-curtailment-critical-20-twh-loss-by-2025/
[61] See https://www.bnamericas.com/en/analysis/brazil-sets-new-schedule-for-power-and-oil-gas-auctions

6. Conclusions

Brazilians show exceptionally high concern about environmental degradation and climate change. According to a 2024 survey conducted by Earth4All, 92% of Brazilian respondents indicated they were "very/quite worried" about the current state of nature, and 94% expressed similar concern about the legacy left for future generations.[62] Meanwhile, the survey found that 74% believe major action must be taken within the next decade to reduce emissions from electricity, transport, food, industry and buildings, well above many G20-country averages.[63] These results underscore a broad public consensus on the urgency of climate and nature challenges in Brazil.

Support for structural reform is similarly strong among Brazilian citizens. The Earth4All survey found that 72% believe "nature is already too damaged to continue meeting human needs in the long-term".[64] Another recent summary of polling for Brazil by the Climate Scorecard reports that over 80% of Brazilians support investment in renewables such as wind and solar, and place priority on health and wellbeing over profit and pure growth.[65] At the same time, public trust in government action remains muted: only 35% believe the government is doing enough to tackle climate change and environmental damage.[66] This combination of high concern, reform appetite and cautious trust outlines a mandate for bold policy action.

Yet important gaps remain. A survey by the Fundação Getulio Vargas (FGV) found that although most Brazilians acknowledge that climate change exists and is human-caused, 44% remain skeptical about the severity of its impact on their own lives.[67] This indicates that while concern is high in aggregate, personal urgency may still lag. Furthermore, while many support nature-based climate solutions (66% according to a poll by The Nature Conservancy in Brazil in 2024) this suggests there is still room to deepen popular engagement and ensure policy alignment.[68]

Taken together, the data portray a Brazilian public that is anxious yet pragmatic, acutely aware of ecological risks and broadly supportive of transformative change linking climate action with social justice. The challenge for policymakers is to translate this favourable sentiment into credible delivery, with institutional transparency, inclusion and accountability. The strong public mandate presents a real opportunity. If Brazilian leadership aligns policy ambition and investment with this social undercurrent, it could accelerate the transition to a greener, more equitable economy domestically and rise as a global leader. Fortunately, the Earth4All assessment points to a number of key priorities to achieve this vision.

The key turnarounds

The poverty turnaround is within reach, but it will depend on shock-proof, adaptive delivery and fiscal innovation. Brazil's social protection system which is anchored by Bolsa Família, Pé-de-Meia, Desenrola, and the cashback mechanism has rebuilt its poverty-reduction foundations. The next step is to make these programs automatic, climate-responsive, and digitally interoperable, using climate-contingent triggers that expand coverage after disasters. Embedding real-time data systems and budget tagging for resilient housing, water, and sanitation will accelerate recovery from floods or droughts. In parallel, creating a Climate–Poverty Sovereign Wealth Fund, possibly financed through the Sistema Brasileiro de Comércio de Emissões de Gases de Efeito Estufa auction revenues, green bonds, and redirected fossil-fuel subsidies, would help guarantee long-term funding for social protection and ecosystem restoration, insulating progress from fiscal shocks.

[62] See https://earth4all.life/wp-content/uploads/2024/08/Global-Commons-Survey-2024-Brazil-Country-Deck.pdf
[63] Ibid
[64] Ibid
[65] See https://www.climatescorecard.org/2025/09/brazil-what-recent-climate-polling-tells-us
[66] See https://earth4all.life/wp-content/uploads/2024/08/Global-Commons-Survey-2024-Brazil-Country-Deck.pdf
[67] See https://portal.fgv.br/en/news/survey-explores-what-brazilians-think-about-climate-change
[68] See https://www.nature.org/en-us/what-we-do/our-insights/perspectives/natural-climate-solutions-poll-brazil-united-states-canada/

An inequality turnaround is plausible, yet transparency, enforcement and participation must advance together. Equal-pay laws, redesigned transfers, and progressive tax reform are narrowing wage and wealth gaps, but impact will hinge on systematic compliance and social legitimacy. Linking pay-equity and climate-disclosure compliance to preferential green credit, procurement eligibility, and sustainable-finance incentives will hard-wire fairness into Brazil's economic model. At the same time, expanding care infrastructure, improving enforcement capacity at the municipal level, and scaling citizen-monitoring mechanisms such as participatory dashboards and the Conselhos de Políticas Sociais will help ensure these policies remain trusted and inclusive. Transparency and trust are preconditions for the broad political coalition needed to sustain tough climate measures.

The energy turnaround is well within reach, but depends on investment in grid capacity and system flexibility. With 88% of electricity from renewables, Brazil is uniquely positioned to lead the global clean-energy race. Achieving this will require reducing fossil fuel drilling, fast-tracking transmission expansion, grid-storage markets and demand-response programs, supported by Eco Invest Brasil and the Brazil Climate and Ecological Transformation Investment Platform to crowd in private capital. The establishment of multi-stakeholder innovation hubs can coordinate planning between regulators, operators and communities, ensuring that new infrastructure delivers tangible social benefits such as jobs, affordable tariffs and resilience upgrades. If these enabling systems scale by 2030, Brazil could become a renewable-energy superpower and export model for just energy transitions. The just energy transition will depend on investment plans that are aligned with long-term renewable growth and demand, not with the short-term needs of thermal backstop plants. Policymakers should signal the glide path for fossil assets now through regulation, market design and disclosure so that capital turns over on schedule rather than suddenly strands in the late 2030s. That will protect balance-sheets, lower the cost of capital and accelerate the very transition that reduces systemic risk.

A food-systems turnaround is attainable if finance, enforcement and innovation align. The ABC+ Plan, Plano Safra, and PPCDAm/PPCerrado provide policy scaffolding for regenerative agriculture and deforestation control. To consolidate these gains, Brazil must maintain credit and tax incentives tied to traceability, CAR/PRA compliance, and no-conversion rules, while scaling landscape-level restoration that secures water resources and biodiversity corridors. Integrating data from Conab, INPE, Embrapa and lenders into interoperable dashboards would improve risk mapping and target credit toward high-impact resilience practices. Institutionalising innovation through a multi-stakeholder food and agriculture innovation hub and localised policy labs would ensure adaptive learning across regions. These reforms can connect farm productivity to basin-scale resilience, closing the loop between food security, equity, and ecosystem health.

An empowerment turnaround is likely, but only if fiscal and institutional reforms translate into capital and opportunity. Brazil's legal framework, anchored by the Ministry of Women and pay-equity laws, has set a strong foundation for gender equality. Scaling success will require enforcing pay-gap transparency, rewarding gender-inclusive firms through green finance and procurement, and expanding training for women in renewables, agroecology, and climate-resilience services. Embedding gender-responsive design in disaster response, cash transfers and gender-based violence services is vital, especially in flood- and heat-prone regions. Complementary measures such as social impact bonds, participatory digital platforms like Participativo and youth-led campaigns can finance empowerment and reshape cultural norms. Overcoming care burdens, informality and under-investment in gender programs would not only boost equality but also accelerate the entire climate transition.

The key enabling factors

Climate and inclusion policies do not operate in a vacuum; they change status and power, and thus elicit responses. The model's most potent constraint is the elite-perception loop - the sense among winners of the old order that they are losing. Left unattended, it will sap trust and shrink the state's capacity to act. The antidote is painstaking but feasible. It requires engaging political parties across the spectrum around a shared competitiveness and wealth redistribution agenda that will guarantee more stability and social cohesion in the country. It also demands the design of benefit-sharing plans and programs for affected sectors and regions. Also needed is the link between redistribution to productivity and opportunity (skills, infrastructure and innovation). Finally, leaders will need to communicate with unusual candour about trade-offs. This is not appeasement but rather political engineering to keep the transition moving and social tension down.

Brazil enters the next decades with enviable advantages: a vast renewable base, unrivalled natural capital, a diversified economy and a democracy capable of course correction. The Earth4All lens shows how to turn those assets into durable gains. The big meta-level tasks are threefold: tame harmful loops by eliminating incentives to clear forests and by diversifying beyond hydro to wind, solar and storage; amplify virtuous loops with targeted credit, services and gender-inclusive leadership so productivity and fiscal space rise together; and tune the stabilisers so shocks don't cascade into crises. Above all, build political durability by anticipating elite push-back, linking climate action to competitiveness and jobs, and sharing benefits transparently to keep a broad coalition intact.

Nature loss however, is a binding constraint on Brazil's most ambitious turnarounds. Accelerating deforestation and degradation in the Amazon, Cerrado, Pantanal, Caatinga and Mata Atlântica weaken carbon sinks, disrupt hydrological cycles, depress crop and pasture productivity and reduce hydropower reliability. All of this can raise food prices, energy costs and health burdens from smoke and heat. Left unchecked, these feedbacks make it far harder to cut emissions, lift rural incomes and sustain social trust by 2050, because every real gain in poverty reduction, equity and empowerment must fight against worsening ecosystem services and disaster risk.

Mining of critical minerals which are essential for clean energy can either enable or undermine the Giant Leap. If extraction expands without strict safeguards (no-go zones in high-biodiversity and Indigenous areas, free prior and informed consent, water budgeting, tailings safety, rehabilitation bonds) it will amplify land conflicts, pollution and inequality This in turn will erode legitimacy and delay future projects. Managed well, including powered by renewables, with strong traceability, local value-add and recycling, critical minerals can lower technology costs, finance community benefits and accelerate grid and storage build-out. The difference determines whether Brazil arrives in 2050 with resilient biomes and inclusive prosperity, or with stranded assets, rising social tensions, and missed climate targets.

Achieving Brazil's Great Leap will also require front-loaded, multi-year investment across land, energy and social systems, likely in the low single-digit percent of GDP annually this decade. On the real economy side, this implies accelerated grid and transmission build-out, utility-scale storage, distributed renewables, clean transport infrastructure and industrial decarbonisation. Also required is large-scale restoration and pasture reconversion, forest code enforcement, Indigenous land protection and climate smart agriculture. With respect to social systems, spending will be required to scale cash transfers, target rural credit, strengthen skills and care infrastructure that translate decarbonisation into jobs and resilience. These outlays also include transition costs such as early retirement or retrofit of high-emitting assets, just-transition packages for affected workers and regions, and resilience upgrades to protect assets from droughts, floods and fires.

Financing a National Giant Leap will demand a blended architecture that mobilises public budgets and crowd-in private capital at scale. A big priority for authorities is to reduce frictions for investment through predictable clean energy auctions and interconnection pipelines. The Brazilian Development Bank and state banks can also provide debt and guarantees, scale-up green, social and sustainability bonds, offer results-based payments for verified restoration and accelerate risk-sharing from multilateral development banks to lower the cost of capital. Fiscal space can be expanded by phasing out harmful subsidies, improving tax progressivity and enforcement, recycling carbon revenues to protect low-income households while de-risking clean investment and channelling a portion of oil and mineral rents into a sovereign transition fund. This will require costed pathways, financing mixes and sequencing options. The intent here is to signal the order of magnitude, the building blocks and the institutional arrangements required to deliver the turnarounds on time.

To a large extent, industry and investors are the builders of Brazil's National Giant Leap. They turn policy into power lines, clean plants, efficient fleets and transparent supply chains. Their job is to mobilise long-term capital and innovation. It is critical for Brazil to engage the private sector across key turnaround sectors in signing renewable PPAs, financing transmission and storage, electrifying logistics, modernising factories and scaling circular solutions, so cleaner growth means lower costs, better air and more resilient jobs.

Credibility and speed come from how firms operate. Brazil and international actors should ensure the adoption of traceability and no-conversion rules in agriculture and mining, publish clear climate-and-nature disclosures, use internal carbon prices and link executive pay to emissions, safety and restoration targets. Partnering with cities, Indigenous and traditional communities, and workers through co-designed projects, reskilling and just-transition plans spreads benefits and reduces risk. Likewise, green and sustainability-linked finance with the Brazilian Development Bank and multilaterals unlocks the capital needed for Brazil to lead on climate and competitiveness. If Brazil executes on this agenda, and works hand in glove with the private sector, investors and citizens it can pair climate neutrality with cohesion and prosperity. Brazil would do well to publish short, public performance metrics such as hydro reliability, non-hydro renewables plus storage, forest regeneration, smallholder incomes, inequality, women in leadership and social cohesion and update assumptions openly to anchor trust. With disciplined policy and clear accountability, each step will make the next easier, compounding into a cleaner grid, thriving rural economies, safer biomes and a fairer economy. Progress towards the Giant Leap will come not from a single leap but from steady system rewiring across Brazil's economy, finance sector, industrial base, governance system and social fabric.

Earth 4All

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Earth4All is an international initiative to accelerate the systems changes we need for an equitable future on a finite planet. Combining the best available science with new economic thinking, Earth4All was designed to identify the transformations we need to create prosperity for all. Earth4All was initiated by The Club of Rome, the Potsdam Institute for Climate Impact Research, the Stockholm Resilience Centre and the Norwegian Business School. It builds on the legacies of *The Limits to Growth* and the planetary boundaries frameworks.

Earth4All is committed to advancing systems change and the transition to a new climate and economic paradigm through three interconnected pillars. These pillars reflect the overarching framework of our substantive work and core objectives, namely to:

- Create compelling evidence for systems change through transformative research, system dynamics modelling, scientific evidence building and knowledge networks;
- Shape public discourse and culture with new narratives and creative tools that promote justice, wellbeing and planetary stewardship; and
- Bring more people on the journey to influence change by shaping and creating new policy, decision-making alliances that uphold wellbeing and planetary boundaries.