

Where storing carbon in trees is more profitable than agriculture in Brazil

Guy Turner, Head of Carbon Markets, MSCI

Dr Alexander Koch, Vice President, MSCI Climate Risk Center

Clarissa Llanaj, Analyst, MSCI Climate Risk Center

MSCI modelling shows that forests in Brazil can be significantly more valuable standing than when cleared for timber or agriculture. These conclusions come from analysis using the latest version of MSCI's Nature Asset Valuation Tool – a global model run on each square km of available land comparing the value of sequestered carbon and agriculture and risks from deforestation.

Assuming a global carbon price of 50 USD/tCO₂ - a recognizable future price for long-term nature-based carbon credits - shifting land from agriculture and timber production to reforestation and avoided deforestation in Brazil could deliver the following:

- **37 bn USD per year in net profits for landholders.** This includes 68bn USD per year revenue from carbon credit sales, less 17bn USD to build and operate forest projects, and 15 USD bn of forgone profits from agriculture and timber extraction.
- **76 million hectares (ha) of land could be either restored (known as Afforestation, Restoration and Reforestation or ARR) or preserved (known as Reduced Emissions from Deforestation and Degradation, or REDD+).** This represents just under 30% of the current land area used for cropland and intense pastureland across Brazil.
- **Making these changes would save around 1.4 bn tonnes of CO₂ per year from carbon preserved in existing forests and through new forest growth. Just under three quarters of the carbon sequestration potential would be from restoration projects.** This is due to the current large areas of degraded and restorable land, combined with a reduction in underlying deforestation rates in Brazil expected up to 2050.¹
- **To achieve these outcomes would require scaling up forest carbon project activity in Brazil by a factor of 20.** Total reforestation and avoided deforestation credits issued since 2010 amount to just under 850 MtCO₂, equivalent to an annual average of 60 MtCO₂e per year - around 5% of the 1.4 bn tonnes annual potential at 50 USD per tonne of CO₂.²

¹ See Appendix for more information on population-driven deforestation rates.

² MSCI Carbon Markets issuances data for ARR and REDD+ projects as of 01/10/2025

1. Introduction

From 2001 to 2024, Brazil has lost an estimated 74 million ha of tree cover, with an average annual deforestation rate of 0.59% per year.³ This loss of forest cover has resulted in average emissions of 1.59 bn tonnes of CO₂ per year. This is equivalent to nearly a third of net greenhouse gas emissions of the US.⁴

Much of this forest loss is in the Amazon region, a vital reserve of flora and fauna, containing around 10% of the world's biodiversity. These valuable natural resources are severely threatened - around 20% of the Amazon has been deforested and a further 6% is "highly degraded".⁵

The primary causes of deforestation in Brazil are timber extraction and agricultural expansion. Agricultural land now covers about 258 million ha or 31% of Brazil's total land area.⁶ The land is divided between 202 million ha of pasture, used for livestock, and 56 million ha of cropland that produces crops such as soy and maize.

Slowing down the rate of deforestation and restoring land to forests is key to preserving these globally important natural assets in South America. While domestic policies and regulations can help tackle some aspects of deforestation, the private sector can also play an important role through the global carbon market. As shown in this paper, revenues from the sale of carbon credits can provide a more lucrative income for farmers and landholders than felling trees and converting the land to agriculture.

2. Methodology

The analysis in this paper uses the MSCI Nature Asset Valuation Tool (NAVt) - a global land-use modelling framework designed to assess deforestation risk, restoration potential, and the economics of carbon-based projects (Exhibit 1).

The foundation of the model is a 1 km² cropland map, constructed by combining multiple high-resolution land-use datasets and harmonizing them to a consistent global grid.⁷ The model uses machine learning techniques to allocate harvest areas and yields for 33 major producing crops.⁸

Areas of cropland converted from forest were designated as restorable, forming the basis for reforestation potential assessments.⁹ The deforestation risk component identifies forests most likely to be cleared for commodity production over the next 25 years. For each "at risk" location, the model estimates the expected post-deforestation land use, corresponding yields, and future revenues. Future

³ Relative to tree cover extent in 2000. World Resources Institute. (2025). *Global Forest Watch – Brazil country dashboard: Tree cover loss & forest change data*, accessed 19/10/2025 [\[Link\]](#)

⁴ US-EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks [\[Link\]](#)

⁵ WWF Inside the Amazon, accessed 22/10/2025 [\[Link\]](#)

⁶ MSCI analysis of Global Pasture Watch, ESRI 10m Annual Land Cover, ESA WorldCover, UMD GLAD, and GLC_FCS30D land cover products.

⁷ See footnote 6.

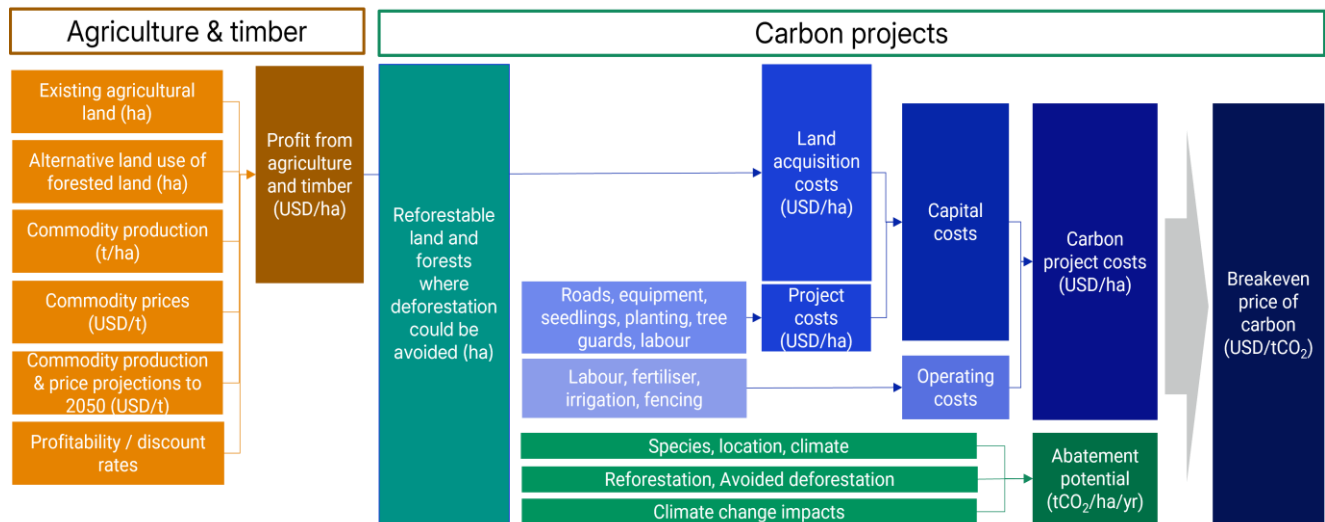
⁸ Including soybean, maize, cotton, rice, beans, oil palm, sugar cane.

⁹ Conservation potential is based on the restorable area in Griscom et al. 2017 [\[Link\]](#) and forests under high deforestation risk based on MSCI's deforestation risk model.

revenues are based on projected commodity prices using the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) developed by IFPRI (International Food Policy Research Institute). The framework distinguishes between small- and large-scale farming systems and incorporates additional land uses such as livestock and logging. Logging is further differentiated by end use, capturing both domestic production (wood-fuel) and export-oriented timber harvesting for industrial or commercial markets (sawn wood).

The baseline deforestation rate, against which the potential for *Reduced Emissions from Deforestation and Degradation* (REDD+) projects is measured, is calculated using a population driven deforestation model. This model integrates spatial probability analysis with peer-reviewed empirical analysis of forest transition theory to estimate future forest loss and associated carbon emissions, accounting for changes in population pressure, accessibility, and land-use dynamics. More details are provided in the Appendix.

Exhibit 1. NAVT modelling framework



Source: MSCI Carbon Markets.

Gross production values are calculated as the product of current/potential commodity production (tonnes) and the three-year average of the most recent FAO country-level producer prices (USD/tonne). Where FAO country-level producer prices are unavailable, the global median price is substituted in that country.¹⁰

Land value in the modelling framework is defined as the capitalized land rent, representing the present value of the stream of profits attributable to land as a productive asset. It is calculated as the production value minus production costs (i.e. profit), with sector-specific margins, consistent with regional benchmarks of land use (e.g., livestock: 8%, timber: 10%, and crops: 10.5% for Latin America), discounted over 25-years using country-level rates (e.g., 10% for Brazil).¹¹ This measure reflects the economic value of producing land under current or potential land use.

¹⁰ FAO. FAOSTAT Statistical Database [\[Link\]](#)

¹¹ VERRA VT0008 Additionality Assessment, v1.0 (14/10/2024) [\[Link\]](#)

Carbon project costs are divided into three components: opportunity costs, implementation costs, and operating costs. Land value reflects the discounted profits from agricultural/timber production through 2050, while implementation and operating costs are sourced from over 250 global datasets compiled by MSCI Carbon Markets and similarly discounted over the same period.¹²

The break-even carbon price is calculated as the carbon price needed to equate investment returns from the sale of carbon credits to that of agricultural production and timber extraction. Abatement from reforestation is based on peer-reviewed carbon accumulation data, and abatement from avoided deforestation is derived from modelled emissions associated with at-risk forest carbon stocks.¹³ By identifying locations with positive net returns, the model identifies where reforestation or conservation may deliver higher economic returns than continued or future agricultural expansion.

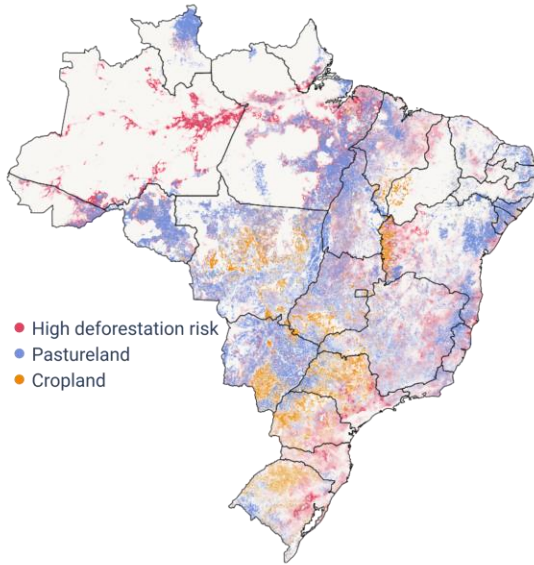
Exhibit 2 shows the land areas designated in terms of deforestation risk and the break-even price of carbon needed to equate the value of agriculture and timber to that of carbon credit sales. Plot (a) shows the current land-use distribution showing cropland, pastureland, and areas at high deforestation risk; plot (b) shows the breakeven carbon price (USD/tCO₂) for avoided deforestation projects (REDD+), indicating the minimum carbon price required to make avoided deforestation financially competitive with alternative land uses; plot (c) shows the breakeven carbon price (USD/tCO₂) for restoration (ARR) projects, representing the minimum carbon price incentive needed to induce landholders to reforest or restore degraded land; plot (d) shows the combined breakeven carbon price (USD/tCO₂) integrating avoided deforestation and restoration opportunities to reflect the overall carbon price threshold required to shift land-use incentives towards conservation and restoration.

¹² Timber prices from ITTO Biennial Review and Assessment 2023–2024 [[Link](#)], agricultural production and prices from FAOSTAT Crops and livestock products [[Link](#)] and FAOSTAT Value of Agricultural Production [[Link](#)], accessed 04/08/2025

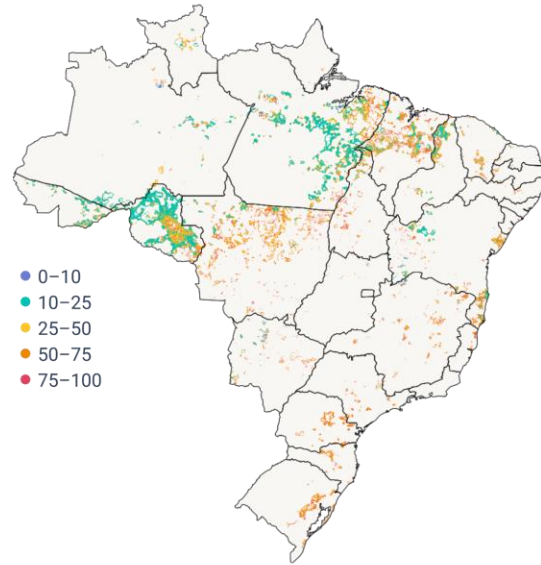
¹³ Cook-Patton et al. [[Link](#)]

Exhibit 2. Spatial distribution of carbon project profitability in Brazil

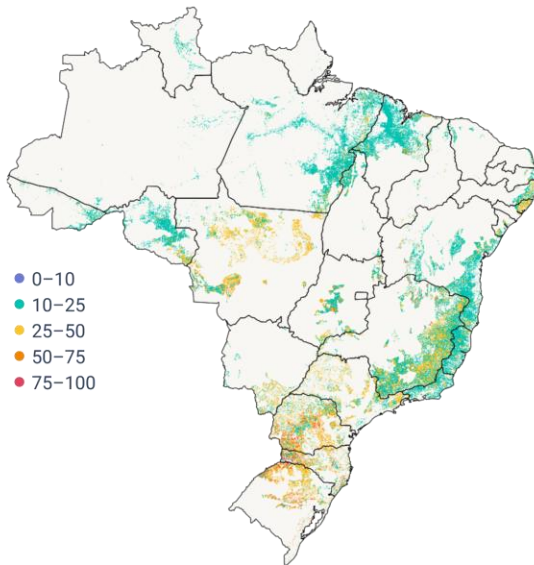
(a) Current land use and high deforestation risk (25-years)



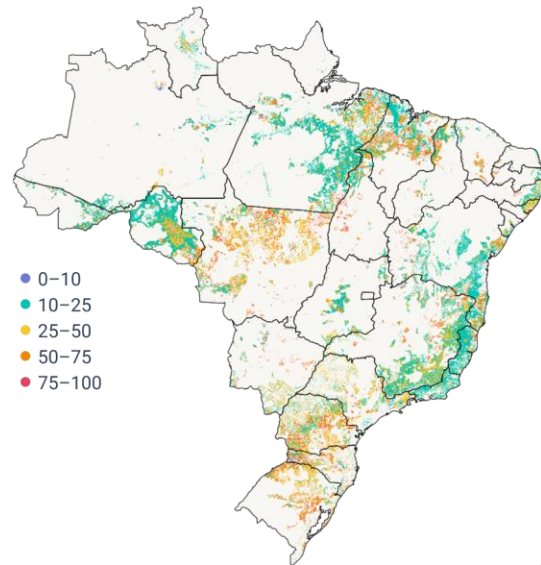
(b) Breakeven carbon price of avoided deforestation (REDD+) (USD/tCO₂, 25-years)



(c) Breakeven carbon price of restoration (ARR) (USD/tCO₂, 25-years)



(d) Combined breakeven carbon price of avoided deforestation and reforestation (REDD+, ARR) (USD/tCO₂, 25-years)



Source: MSCI Carbon Markets, as of Oct. 2025.

3. Results and conclusions

The results of the modelling for the whole of Brazil are shown in Table 1. Overall, we estimate that some 76 million ha of land could be both restored or preserved at a global carbon price of 50 USD per tonne of CO₂. This represents just under 30% of the current land area used for some form of cropland and intense pastureland across Brazil (258 million ha).

Table 1. Impacts of REDD+ and ARR projects in Brazil compared to agriculture and timber extraction (annual equivalent values over the period 2025 to 2050).

	International carbon price (USD/tCO ₂ , real)				
	10	25	50	75	100
Annual average revenue from carbon credits (bn USD/yr)	0.0	22	68	109	149
Ann. avg. operating costs for carbon projects (bn USD/yr)	-0.0	-11	-17	-17	-18
Ann avg foregone profits from agriculture/timber (bn USD/yr)	-0.0	-4	-15	-20	-23
Annual average net profit (bn USD/yr)	0.0	7	37	72	109
Abatement (MtCO₂/yr)	5.2	916	1,405	1,535	1,593
Conservation area (million ha)	0.2	47	76	83	87
Conservation areas as % of agricultural area (%)	0.1%	18%	29%	32%	34%

Source: MSCI Carbon Markets, as of Oct. 2025.

Making these changes would save around 1.4 bn tonnes of CO₂ per year from carbon preserved in existing forests and through new forest growth at 50 USD per tonne of CO₂. The carbon sequestration rates are average annualized carbon accumulation rates over the first 20 years of natural forest regrowth, summed across above- and below-ground biomass.¹⁴

From an economic perspective, at a global carbon price of 50 USD per tonne of CO₂, landholders in Brazil could earn an average of around 68 bn USD per year from carbon credit sales. We estimate these carbon projects would require around 17 bn USD to build and operate on an annualized equivalent basis, and have an opportunity cost of around 15 bn USD in terms of forgone profits from agriculture and timber extraction at the farm level.¹⁵ Overall, the average net profits per year over the period 2025 to 2050 would be around 37 bn USD per year. The modelling calculates that up to 30% of land area used for agriculture could be profitably used for carbon sequestration at a global carbon of 50 USD per tonne.

Table 2 and Table 3 show the contribution of REDD+ and ARR project respectively. Just under three quarters of the economically viable carbon sequestration potential is from ARR projects. This is due to the large areas of degraded and restorable land, combined with the modelled projection of a reduction in underlying deforestation rates in Brazil up to 2050.

Some 65 million hectares have ARR restoration potential. Of this area, around 60 million hectares is viable at a price of under 50 USD/tCO₂. Of those 60 million hectares, over one-third (25 million hectares) are found in Atlantic Forest biome region alone. This scale exceeds Brazil's national target of restoring 12

¹⁴ See footnote 13.

¹⁵ Revenues and profits are calculated at the farm level and do not include downstream profits from processing, distribution and retail.

million hectares of native vegetation by 2030 and highlights the potential to extend current policy ambitions.¹⁶

This level of restoration could be achieved with relatively limited trade-offs. Redirecting land toward ARR projects at a price of 50 USD/tCO₂ would reduce annual crop and livestock production by 15% and 26%, respectively, in areas which are least profitable for agriculture and most productive for tree growth. Most of the livestock reduction comes from reforestation of pastureland, where livestock systems and reforestation could co-exist.¹⁷

The contribution of REDD+ projects is less than ARR due to the projected slowing down of deforestation activity. Based on our population-driven deforestation model, the rate of deforestation in Brazil is projected to reduce from 0.59% per year (3 million ha/yr) between 2000 and 2025, to 0.28% per year (1.3 million ha/yr) between 2025 and 2050. The modelled decline in deforestation is consistent with the population-based framework that as demographic pressure eases and land demand stabilizes, conditions become more favorable for restoration projects.

Table 2. Impacts of REDD+ projects in Brazil compared to agriculture and timber extraction (annual equivalent values over the period 2025 to 2050)

	International carbon price (USD/tCO ₂ , real)				
	10	25	50	75	100
Annual average revenue from carbon credits (bn USD/yr)	0	4	12	21	30
Ann. avg. operating costs for carbon projects (bn USD/yr)	0	-1	-1	-1	-1
Ann avg foregone profits from agriculture/timber (bn USD/yr)	0	-2	-5	-7	-9
Annual average net profit (bn USD/yr)	0	1	6	12	19
Abatement (MtCO₂/yr)	5.2	232	375	462	511
Conservation area (million ha)	0.2	9	16	20	23
Conservation areas as % of agricultural area (%)	0.1%	3%	6%	8%	9%

Source: MSCI Carbon Markets, as of Oct. 2025.

Increasing the assumed global carbon price does not significantly alter the optimal change in land-use. At an international carbon price of 100 USD per tonne of CO₂, the abatement potential only increases to 1.6 bn tonnes per year using 34% of the potential agricultural land (versus 1.4 bn tonnes per year at 50 USD). This is because the most cost-effective restoration opportunities are concentrated on pastureland, where economic returns from livestock are modest compared to those from restorable cropland.

¹⁶ Decree No. 8.972 creating the National Policy for the Recovery of Native Vegetation. FAOLEX Database, accessed 08/10/2025 [\[Link\]](#)

¹⁷ See for example Feltran-Barberie, R. & Feres, G. [\[Link\]](#)

Table 3. Impacts of ARR projects in Brazil compared to agriculture and timber extraction (annual equivalent values over the period 2025 to 2050)

	International carbon price (USD/tCO ₂ , real)				
	10	25	50	75	100
Annual average revenue from carbon credits (bn USD/yr)	0	19	57	88	119
Ann. avg. operating costs for carbon projects (bn USD/yr)	0	-10	-16	-16	-16
Ann avg foregone profits from agriculture/timber (bn USD/yr)	0	-2	-10	-12	-13
Annual average net profit (bn USD/yr)	0	6	31	60	90
Abatement (MtCO₂/yr)	0	684	1,030	1,073	1,082
Conservation area (million ha)	0	38	60	63	64
Conservation areas as % of agricultural area (%)	0%	15%	23%	24%	25%

Source: MSCI Carbon Markets, as of Oct. 2025.

Table 4 summarizes the results at a regional level for the central scenario of a global carbon price of 50 USD for tonne of CO₂. Some 75% of the conservation and restoration potential lies within six of 27 regions in Brazil (Pará, Mato Grosso, Rondônia, Minas Gerais, Maranhão, Bahia).

Table 4. Impacts of REDD+ and ARR projects by region (assumes 50 USD per tonne of CO₂)

Region	Annual average net profit (USD m/ yr)	Abatement (MtCO ₂ /yr)	Conservation area (million ha)
Pará	8,736	314	14
Mato Grosso	3,863	197	10
Rondônia	4,675	174	9
Minas Gerais	3,983	149	10
Maranhão	3,319	109	6
Bahia	2,905	89	6
Acre	964	46	1
Paraná	831	40	3
Amazonas	920	40	1
São Paulo	771	37	3
Espírito Santo	1,214	35	2
Tocantins	856	29	2
Goiás	760	28	2
Rio de Janeiro	691	21	1
Mato Grosso do Sul	395	19	1
Rio Grande do Sul	225	15	1
Roraima	354	13	1
Piauí	184	11	1
Pernambuco	317	11	1
Alagoas	234	9	1
Santa Catarina	150	8	1
Sergipe	130	5	<1
Ceará	77	3	<1
Paraíba	91	3	<1
Amapá	26	1	<1
Rio Grande do Norte	36	1	<1
Distrito Federal	<1	<1	<1
Total	36,707	1,407	77

Source: MSCI Carbon Markets, as of Oct. 2025.

Appendix – MSCI deforestation model

The MSCI deforestation model integrates spatial probability modelling with forest transition theory to estimate future forest loss and associated carbon emissions to 2050. Spatial probabilities of deforestation are generated using *ForestAtRisk*, which applies a binomial intrinsic conditional autoregressive (iCAR) model with Markov Chain Monte Carlo (MCMC) estimation to quantify relationships between forest loss and seven biophysical and accessibility drivers.¹⁸ These include distance to roads, rivers, urban areas, forest edge, and previous deforestation; slope and altitude, while accounting for residual spatial autocorrelation. Population pressure acts as an implicit driver, implemented through forest transition curves linking demographic change to declining deforestation rates.

Forest transition describes a characteristic pattern in which a country's forest cover initially declines due to agricultural expansion and population growth but later stabilizes and begins to recover as economies develop and land use becomes more efficient.¹⁹ This shift reflects the interplay between demographic pressure, technological progress and economic transformation that gradually reduces dependence of forest conversion for growth. In the early stages of development, forest cover typically decreases as land is cleared for agriculture, infrastructure and settlement to meet the demands of a growing population. As development advances, improvements in agricultural productivity, urbanization, and shifting economic priorities reduce the pressure on land, leading to a stabilization of forest cover and later forest replenishment.

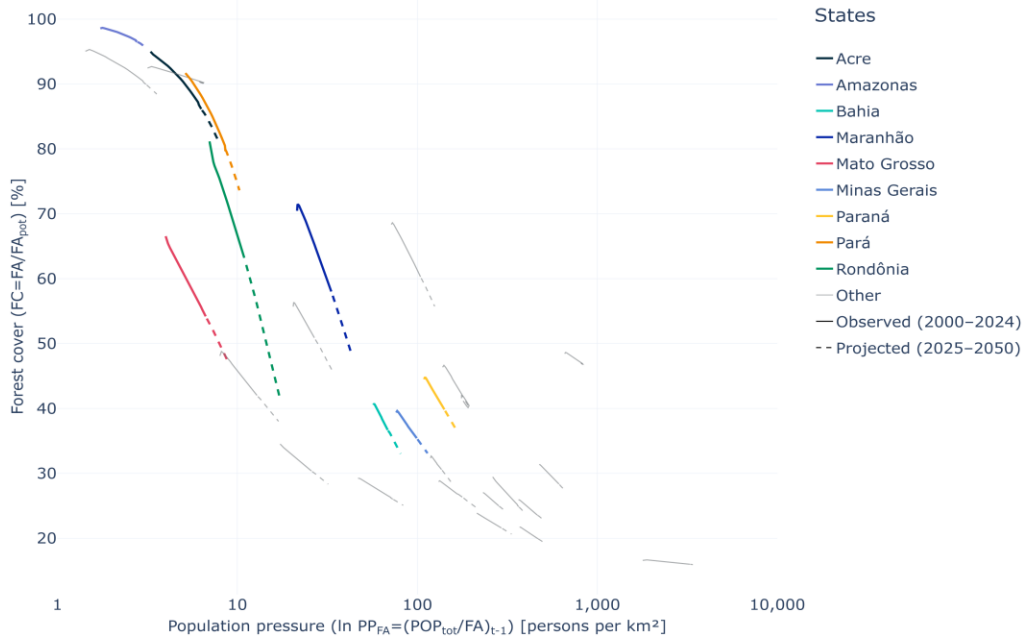
Brazil is modelled at the state-level to capture the country's regional heterogeneity in land-use pressures, governance, and data structures, improving explanatory power and ensuring policy relevance. Figure A.1 shows the state-level deforestation curves derived from population pressure on forest cover, for the observed (2000-2024) and projected (2025-2050) periods. The curves also reveal regional contrasts within the Amazon: Pará shows a clear decline in its projected deforestation rate, while Rondônia continues to exhibit persistently high deforestation intensity.

These dynamics are further illustrated in Figure A.2. Figure A.2(a) shows the projected spatial distribution of deforestation risk between 2025 and 2050, while A.2(b) presents the corresponding breakeven carbon price across Brazilian states, with Rondônia, Pará, and Mato Grosso highlighted to show the conservation potential. Despite their differing positions along the forest transition pathway, large areas within these three states display a significant abatement potential below 100 USD/tCO₂, indicating that a substantial share of cost-effective mitigation opportunities is concentrated in regions where continued deforestation pressure overlaps with relatively low opportunity costs for conservation.

¹⁸ forestatrisk 0.1 Python package description [\[Link\]](#), accessed 23/10/2025

¹⁹ Köthke, M. et al. [\[Link\]](#)

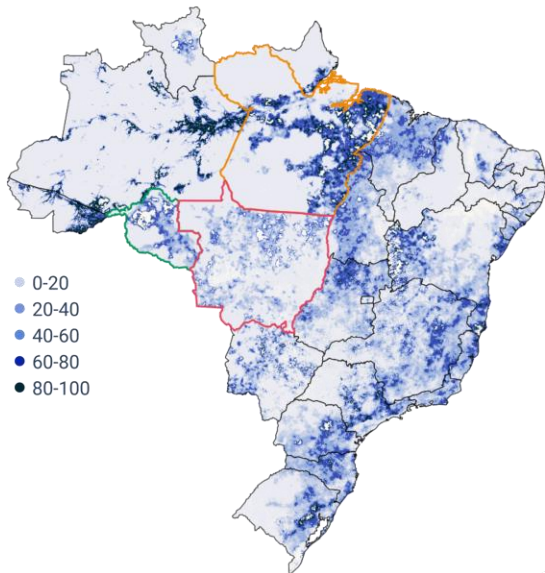
Figure A.1. Deforestation curves for selected states in Brazil (2000-2050)



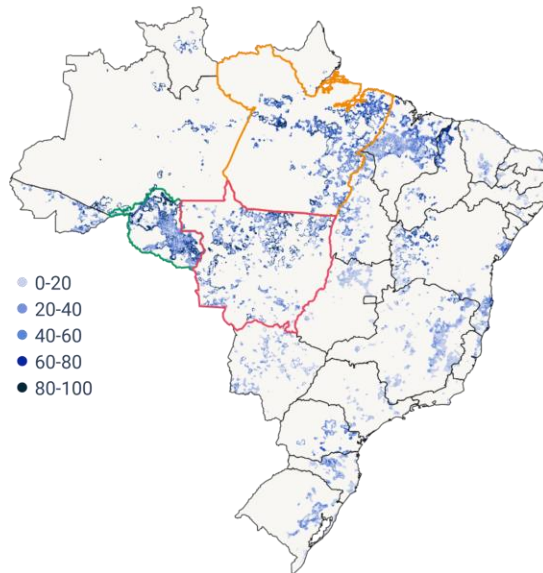
Source: MSCI Carbon Markets, as of Oct. 2025.

Figure A.2. Spatial distribution of deforestation risk and conservation potential in Brazil.

(a) Deforestation risk (SSP2) (% , 25-years)



(b) Projected deforestation (SSP2) (ha, 25-years)



Source: MSCI Carbon Markets, as of Oct. 2025.

Contact us

About MSCI Inc.

MSCI (NYSE: MSCI Inc.) strengthens global markets by connecting participants across the financial ecosystem with a common language. Our research-based data, analytics and indexes, supported by advanced technology, set standards for global investors and help our clients understand risks and opportunities so they can make better decisions and unlock innovation. We serve asset managers and owners, private-market sponsors and investors, hedge funds, wealth managers, banks, insurers and corporates.

To learn more, please visit www.msci.com/msci.com/contact-us

The process for submitting a formal index complaint can be found on the index regulation page of MSCI's website at: <https://www.msci.com/index-regulation>.

About MSCI Sustainability and Climate Products and Services

MSCI Sustainability and Climate products and services are provided by MSCI Solutions LLC and certain related entities, and are designed to provide in-depth research, ratings and analysis of environmental, social and governance related business practices to companies worldwide. ESG ratings, data and analysis from MSCI Sustainability and Climate are also used in the construction of MSCI Indexes.

AMERICA

United States	+ 1 888 588 4567 *
Canada	+ 1 416 687 6270
Brazil	+ 55 11 4040 7830
Mexico	+ 52 81 1253 4020

EUROPE, MIDDLE EAST & AFRICA

South Africa	+ 27 21 673 0103
Germany	+ 49 69 133 859 00
Switzerland	+ 41 22 817 9777
United Kingdom	+ 44 20 7618 2222
Italy	+ 39 02 5849 0415
France	+ 33 17 6769 810

ASIA PACIFIC

	+ 86 21 61326611
China	+ 852 2844 9333
Hong Kong	+ 91 22 6784 9160
India	1800818185 *
Malaysia	+ 82 70 4769 4231
South Korea	+ 65 67011177
Singapore	+ 612 9033 9333
Australia	008 0112 7513 *
Taiwan	0018 0015 6207 7181 *
Thailand	+ 81 3 4579 0333
Japan	
	* toll-free

Notice and disclaimer

The data, data feeds, databases, reports, text, graphs, charts, images, videos, recordings, models, metrics, analytics, indexes, ratings, scores, cases, estimates, assessments, software, websites, products, services and other information and materials contained herein or delivered in connection with this notice (collectively, the "Information") are copyrighted, trade secrets (when not publicly available), trademarks and proprietary property of MSCI Inc. or its subsidiaries (collectively, "MSCI"), MSCI's licensors, direct or indirect suppliers and authorized sources, and/or any third party contributing to the Information (collectively, with MSCI, the "Information Providers"). All rights in the Information are reserved by MSCI and its Information Providers and user(s) shall not, nor assist others to, challenge or assert any rights in the Information.

Unless you contact MSCI and receive its prior written permission, you must NOT use the Information, directly or indirectly, in whole or in part (i) for commercial purposes, (ii) in a manner that competes with MSCI or impacts its ability to commercialize the Information or its services, (iii) to provide a service to a third party, (iv) to permit a third party to directly or indirectly access, use or resell the Information, (v) to redistribute or resell the Information in any form, (vi) to include the Information in any materials for public dissemination such as fund factsheets, market presentations, prospectuses, and investor information documents (e.g. KIIDs or KIDs), (vii) to create or as a component of any financial products, whether listed or traded over the counter or on a private placement basis or otherwise, (viii) to create any indexes, ratings or other data products, including in derivative works combined with other indexes or data or as a policy, product or performance benchmarks for active, passive or other financial products, (ix) to populate a database, or (x) to train, use as an input to, or otherwise in connection with any artificial intelligence, machine learning, large language models or similar technologies except as licensed and expressly authorized under MSCI's AI Contracting Supplement at <https://www.msci.com/legal/supplemental-terms-for-client-use-of-artificial-intelligence>.

The intellectual property rights of MSCI and its Information Providers may not be misappropriated or used in a competitive manner through the use of third-party data or financial products linked to the Information, including by using an MSCI index-linked future or option in a competing third-party index to provide an exposure to the underlying MSCI index or by using an MSCI index-linked ETF to create a financial product that provides an exposure to the underlying MSCI index without obtaining a license from MSCI.

The user or recipient of the Information assumes the entire risk of any use it may make, permit or cause to be made of the Information. NONE OF THE INFORMATION PROVIDERS MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EACH INFORMATION PROVIDER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, SUITABILITY, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION. Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall MSCI or any other Information Provider have any liability arising out of or relating to any of the Information, including for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages, even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited.

The Information, including index construction, ratings, historical data, or analysis, is not a prediction or guarantee of future performance, and must not be relied upon as such. Past performance is not indicative of future results. The Information may contain back tested data. Back-tested performance based on back-tested data is not actual performance but is hypothetical. There are frequently material differences between back tested performance results and actual results subsequently achieved by any investment strategy. The Information may include "Signals," defined as quantitative attributes or the product of methods or formulas that describe or are derived from calculations using historical data. Signals are inherently backward-looking because of their use of historical data, and they are inherently inaccurate, not intended to predict the future and must not be relied upon as such. The relevance, correlations and accuracy of Signals frequently change materially over time.

The Information may include data relating to indicative prices, evaluated pricing or other information based on estimates or evaluations (collectively, "Evaluations") that are not current and do not reflect real-time traded prices. No evaluation method, including those used by the Information Providers, may consistently generate evaluations or estimates that correspond to actual "traded" prices of any relevant securities or other assets. Evaluations are subject to change at any time without notice and without any duty to update or inform you, may not reflect prices at which actual transactions or collateral calls may occur or have occurred. The market price of securities, financial instruments, and other assets can be determined only if and when executed in the market. There may be no, or may not have been any, secondary trading market for the relevant securities, financial instruments or other assets. Private capital, equity, credit and other assets and their prices may be assessed infrequently, may not be priced on a secondary market, and shall not be relied upon as an explicit or implicit valuation of a particular instrument. Any reliance on fair value estimates and non-market inputs introduces potential biases and subjectivity. Internal Rate of Return metrics are not fully representative without full disclosure of fund cash flows, assumptions, and time horizons.

The Information does not constitute, and must not be relied upon as, investment advice, credit ratings, or proxy advisory or voting services. None of the Information Providers, their products or services, are fiduciaries or make any recommendation, endorsement, or approval of any investment decision or asset allocation. Likewise, the Information does not represent an offer to sell, a solicitation to buy, or an endorsement of any security, financial product, instrument, investment vehicle, or trading strategy, whether or not linked to or in any way based on any MSCI index, rating, subcomponent, or other Information (collectively, "Linked Investments"). The Information should not be relied on and is not a substitute for the skill, judgment and experience of any user when making investment and other business decisions. MSCI is not responsible for any user's compliance with applicable laws and regulations. All Information is impersonal, not tailored to the needs of any person, entity or group of persons, not objectively verifiable in every respect, and may not be based on information that is important to any user.

It is not possible to invest in an index. Exposure to an asset class or trading strategy or other category represented by an index is only available through third party investable instruments (if any) based on that index. MSCI makes no assurance that any Linked Investments will accurately track index performance or provide positive investment returns. Index returns do not represent results of actual trading of investable assets/securities. MSCI maintains and calculates indexes but does not manage assets. The calculation of indexes and index returns may deviate from the stated methodology. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase securities underlying the index or Linked Investments. The imposition of these fees and charges would cause the performance of a Linked Investment to be different than the MSCI index performance.

Information provided by MSCI Solutions LLC and certain related entities ("MSCI Solutions"), including materials utilized in MSCI sustainability and climate products, have not been submitted to, nor received approval from any regulatory body. MSCI sustainability and climate offerings, research and data are produced by, and ratings are solely the opinion of MSCI Solutions. MSCI India Domestic ESG Ratings are produced by MSCI ESG Ratings and Research Private Limited and offered domestically in India. Other MSCI products and services may utilize information from MSCI Solutions, Barra LLC or other affiliates. More information can be found in the relevant methodologies on www.msci.com. MSCI Indexes are administered by MSCI Limited (UK) and MSCI Deutschland GmbH. No regulated use of any MSCI private real assets indexes in any jurisdiction is permitted without MSCI's express written authorization. The process for applying for MSCI's express written authorization can be found at: <https://www.msci.com/index-regulation>.

MSCI receives compensation in connection with licensing its indexes and other Information to third parties. MSCI Inc.'s revenue includes fees based on assets in Linked Investments. Information can be found in MSCI Inc.'s company filings on the Investor Relations section of msci.com. Issuers mentioned in MSCI Solutions materials or their affiliates may purchase research or other products or services from one or more MSCI affiliates, manage financial products



such as mutual funds or ETFs rated by MSCI Solutions or its affiliates or are based on MSCI Indexes. Constituents of MSCI equity indexes are listed companies, which are included in or excluded from the indexes according to the application of the relevant index methodologies. Constituents in MSCI Inc. equity indexes may include MSCI Inc., clients of MSCI or suppliers to MSCI. MSCI Solutions has taken steps to mitigate potential conflicts of interest and safeguard the integrity and independence of its research and ratings.

MIFID2/MIFIR notice: MSCI Solutions does not distribute or act as an intermediary for financial instruments or structured deposits, nor does it deal on its own account, provide execution services for others or manage client accounts. No MSCI product or service supports, promotes or is intended to support or promote any such activity. MSCI Solutions is an independent provider of sustainability and climate data. All use of indicative prices for carbon credits must comply with any rules specified by MSCI. All transactions in carbon credits must be traded "over-the-counter" (i.e. not on a regulated market, trading venue or platform that performs a similar function to a trading venue) and result in physical delivery of the carbon credits.

You may not remove, alter, or obscure any attribution to MSCI or notices or disclaimers that apply to the Information. MSCI, Barra, RiskMetrics, and other MSCI brands and product names are the trademarks, service marks, or registered trademarks of MSCI or its subsidiaries in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and S&P Dow Jones Indices. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and S&P Dow Jones Indices. Terms such as including, includes, for example, such as and similar terms used herein are without limitation.

MSCI and its Information Providers may use automated technologies and artificial intelligence to help generate content and output incorporated in the Information.

Privacy notice: For information about how MSCI collects and uses personal data, please refer to our Privacy Notice at: <https://www.msci.com/privacy-pledge>. For copyright infringement claims contact us at dmca@msci.com. This notice is governed by the laws of the State of New York without regard to conflict of laws principles.