FOREST RESTORATION AT RISK:

How clearing and burning in secondary vegetation threaten Brazilian targets

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SUMÁRIO

1. Executive **summary**

The Amazon has great potential for forest restoration, driven by its natural regeneration capacity. There are at least 5.7 million hectares of secondary vegetation that is six years old or older. However, fires and suppression threaten its permanence and, consequently, the fulfillment of national restoration goals (12 million hectares by 2030), in addition to aggravating climate risks (Guimarães et al., 2024; MMA, 2024a). Between 2014 and 2024, 2.7 million hectares were lost, with an estimated cost of between R$ 814 million and R$ 33 billion for recovery. To reverse this trend, it is recommended to: (1) monitor and inspect secondary vegetation in real time; (2) integrate fire risk into the National Policy for Integrated Fire Management; (3) implement local economic incentives, such as payments for environmental services; (4) designate unused public areas and land tenure gaps for conservation; (5) expand forest concessions on degraded public lands; and (6) prioritize environmental regularization in private areas with low agricultural potential. These measures strengthen governance, promote effective protection, and enable forest restoration.

2. Context and **rationale**

Brazil has reaffirmed its commitment to restoring forest ecosystems in global and national initiatives. On the international stage, it has joined the Bonn Challenge and the 20x20 Initiative, committing to restore 12 million hectares by 2030 (Oliveira and Calixto, 2020). At COP28, it launched the "Arc of Restoration in the Amazon" program, which aims to reverse the "Arc of Deforestation" in 50 municipalities in seven states, with targets of 6 million hectares by 2030 and 24 million by 2050 (MMA, 2024b). At the national level, the New National Plan for Native Vegetation Recovery (Planaveg 2025-2028) reinforces the target of 12 million hectares by 2030 (MMA, 2024a).

Conducting natural regeneration presents a strategic opportunity to meet these targets at a lower cost. Data from the TerraClass project indicated the existence of 16.9 million hectares of secondary vegetation

in the Amazon in 2022, with 31% having undergone more than 14 years of regeneration (INPE, 2024). Guimarães et al. (2024), excluding areas potentially under fallow[1], identified 5.7 million hectares of secondary vegetation six years old or older in 2023. Both results show that there is great potential for forest restoration in the Amazon biome and that the forest maintains its high resilience capacity.

However, these areas face constant threats. Studies show that secondary vegetation suppression reached an annual average of 236,000 hectares between 1992 and 2019 (Pinto et al. 2021). Between 2019 and 2023, 27% of areas aged six years or older were lost—the equivalent of 402,000 hectares/year (Guimarães et al., 2024). With this scenario in mind, ensuring the conservation of secondary vegetation is urgent. This policy brief aims to contribute to the debate on forest conservation and restoration in the Amazon, presenting essential government instruments and actions to address the threats of secondary vegetation suppression and ensure compliance with Brazilian restoration targets.

[1] According to the Forest Code, fallowing is the practice of temporarily interrupting agricultural, ranching, or forestry activities or uses for a maximum of five (5) years to enable the recovery of the soil's physical structure or capacity for use (Brazil, 2012).

3. Evidence and **diagnosis of the problem**

Between 2014 and 2024, areas of secondary vegetation six years old or older suffered a loss of approximately 2.7 million hectares, which is equivalent to twice the territory of the municipality of Altamira — the largest in Brazil. This area could contribute about 23% of the forest restoration target assumed by the country (12 million hectares). In annual terms, this corresponds to an average of 247,000 hectares lost per year, as illustrated in Figure 1.

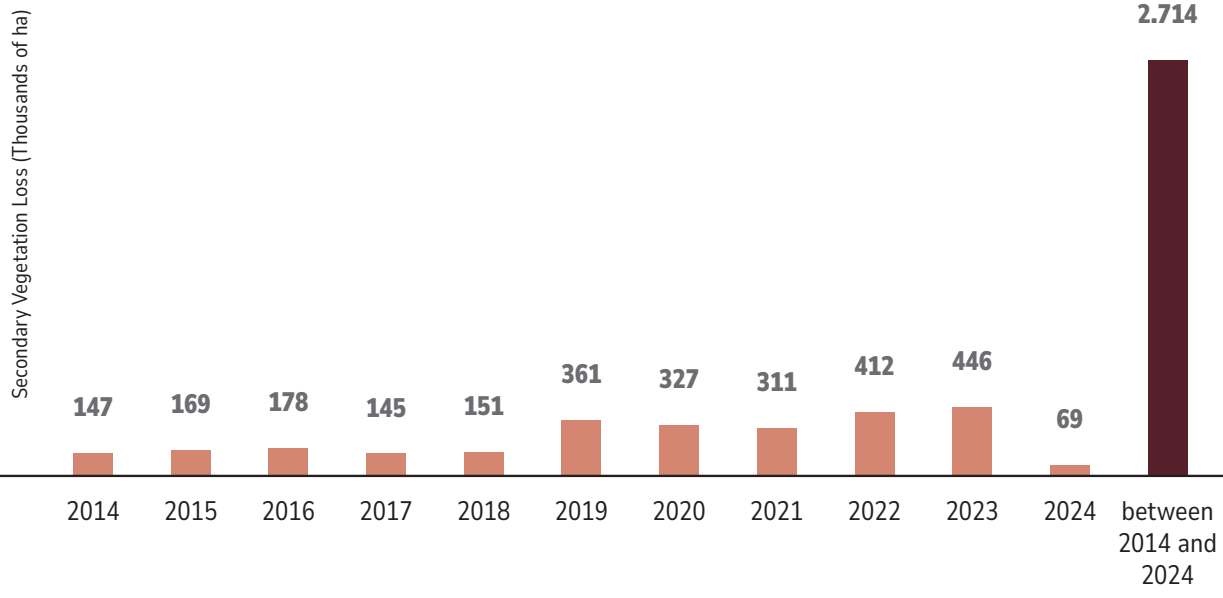


Figure 1. Annual loss of secondary vegetation in the period from 2014 to 2024 in the Amazon biome.

Of this total, the vast majority—approximately 2.3 million hectares or 88%—corresponded to direct vegetation removal. The remaining 12%, equivalent to about 325,000 hectares, was lost due to fires (Figure 2).

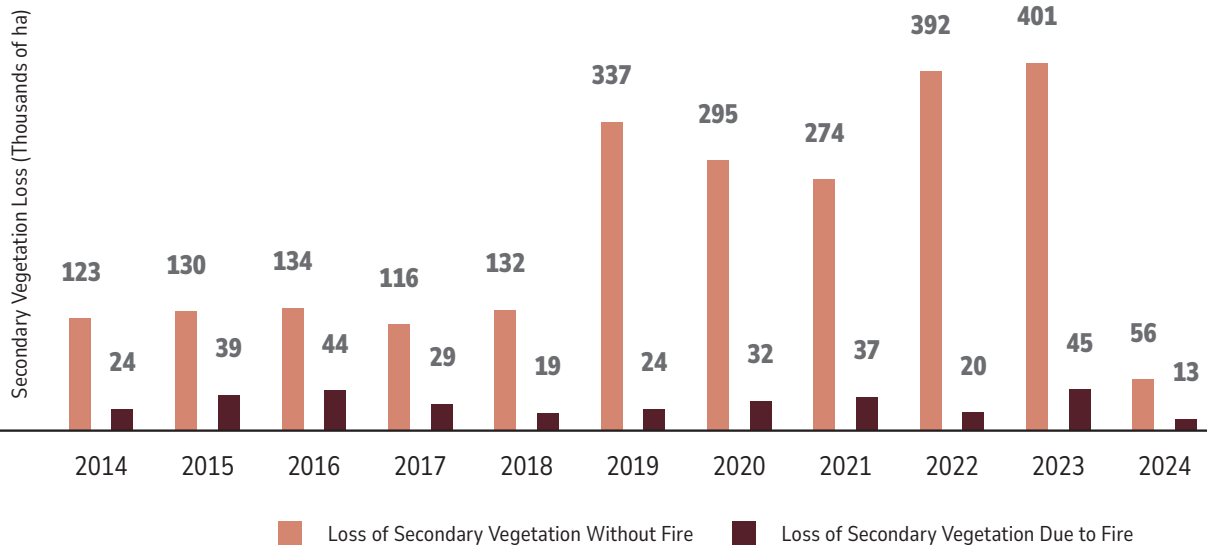


Figure 2. Annual loss of secondary vegetation due to fire and other causes in the period from 2014 to 2024 in the Amazon biome.

Based on Brancalion et al. (2019), it is estimated[2] that restoring the 2.7 million hectares of secondary vegetation (six years old or older) lost in the last decade (2014-2024) would require a substantial financial investment, ranging from US$ 151 million (R$ 814 million) in a natural regeneration scenario (only with protection against possible disturbances), and US$ 6.2 billion (R$ 33 billion) in a total seedling planting approach (Table 1).

In October 2025, the Brazilian government announced, through the Amazon Fund, a financial contribution of R$126 million to boost restoration actions covering 4,600 hectares planting seedlings (Brazil, 2025). This measure is part of the Restoration Arc Project, which will have a total investment of R$ 1 billion, of which R$ 450 million will be allocated to the Restore the Amazon Program (Brazil, 2025).

[2] The costs of restoration methods were based on Brancalion et al. (2019) and updated to December 2024 values. The values in Brazilian reais were adjusted using the IGP-M (FGV) index (2025). The conversion to US dollars (USD) used the average commercial dollar exchange rate for purchases, available from IPEADATA (2025).

Considering the most conservative scenario—R$ 814 million for the natural regeneration of 2.7 million hectares—the total amount allocated for the Restoration Arc (R$ 1 billion) would only be sufficient to cover this minimum estimate. However, if assisted natural regeneration (with fences, invasive species control, etc.) is chosen, for example, the necessary investment would increase substantially, reaching up to R$ 7.5 billion. In the most intensive scenario, based on planting seedlings, the estimated cost would reach around R$ 33 billion, which highlights the magnitude of the financial challenge involved in recovering the areas of secondary vegetation lost in the last decade.

Table 1. Estimated costs for restoring 2.7 million hectares of lost secondary vegetation between 2014 and 2024 in the Amazon biome, by restoration method.

Restoration Methods*	Restoration Cost (US$/ha)	Restoration Cost (US$)	Restoration Cost (R$/ha)	Restoration Cost (R$)
Planting seedlings	2,302.50	6,248,332,867	12,412.08	33,687,340,850
Enrichment planting	1,082.50	2,937,226,097	5,834.69	15,385,797,931
Direct seeding	699.80	1,899,149,707	3,772.59	10,239,099,749
Assisted natural regeneration	508.99	1,381,244,178	2,743.79	7,446,857,331
Natural regeneration	55.65	151,037,321	300.03	814,304,522

*According to Brancalion et al. (2019), but with cost values updated for 2024.

Given the magnitude of the estimated costs for restoring deforested areas, it is essential to understand where and under what conditions secondary vegetation has been suppressed in the Amazon biome. Considering only the year 2024, we found that 55% of the suppressed vegetation (37,600 hectares) had low potential for agriculture, while 45% (about 31,000 hectares) had high potential (Figure 3).

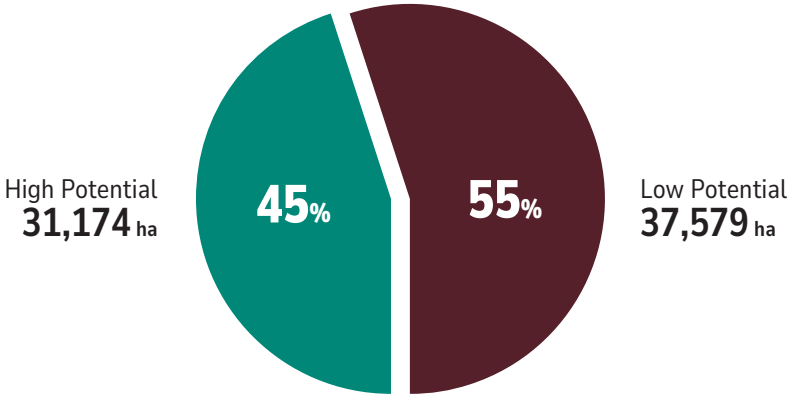


Figure 3. Agricultural potential of secondary vegetation areas cleared in 2024 in the Amazon biome[3].

Most of the secondary vegetation lost in 2024, 73.71% (about 50,700 hectares), was converted to pasture, while 12.75%—approximately 8,800 hectares—was used for crops (Table 2). Another 13.54% (9,300 hectares) was impacted by urban expansion, dam or reservoir construction, and methodological changes[4]. These figures confirm the continued conversion of secondary vegetation to agricultural use, with cattle ranching consolidating its position as the main activity associated with the removal of secondary vegetation.

Table 2. Land use after the loss of secondary vegetation in 2024 in the Amazon biome[5].

Classe	Hectares	%
Pasture	50,678	17.37
Agriculture	8,767	57.21
Other Classes	9,307	45.31
Total	68,753	100.00

[3] The analysis of the agricultural potential of lost secondary vegetation was performed by spatially overlaying three layers: the map of Suppressed Secondary Vegetation (Imazon, 2024), the map of Agricultural Potential (Brandão et al., 2020), and an Exclusion Layer composed of protected, forest, and military areas. For more details, see Guimarães et al. (2024).

[4] The main methodological adjustments were made to the land use and land cover maps (2024 update and improvements) and to the calibration of the algorithm. For more information, we recommend reading the article by Souza Jr. et al., 2023.

[5] The analysis of secondary vegetation conversion was performed by spatially overlaying the Secondary Vegetation Suppressed map (Imazon, 2024) with the Land Use and Land Cover and Accumulated Burned Area maps (MapBiomas, 2025), allowing the identification of the land use class subsequent to suppression.

In 2024, secondary vegetation cleared in the Amazon biome was concentrated in three territorial classes: i) Sigef Private Properties (60.3%); ii) Areas with Rural Environmental Registration (CAR) (16.8%); iii) Rural Settlements (13.7%). Land gaps covered approximately 5.3%; Protected Areas totaled 2.3%; Environmental Protection Areas (APA) accounted for 1.4%; Undesignated Public Areas and Quilombola Lands each represented 0.1% (Table 3).

Table 3. Secondary vegetation cleared in 2024 in the Amazon biome by territorial class.

Territorial Class	Loss of Secondary Vegetation	
	ha	%
Private Properties in Sigef	41,426	60.3
Areas with Rural Environmental Registration (CAR)	11,529	16.8
Rural Settlements	9,422	13.7
Land Tenure Gaps	3632	5.3
Protected Areasa	1577	2.3
Environmental Protection Areas (APA)b	962	1.4
Undesignated Public Areas	102	0.1
Quilombola Lands	103	0.1
Total	68,753	100

[a] Includes Indigenous Lands, Conservation Units (except APAs) and Military Areas, as they comprise lands with protected status. According to Federal Law No. 9,985/2000, agricultural activities are not permitted in these areas.

[b] APAs were treated separately because, according to Federal Law No. 9,985/2000, agricultural activities are permitted in APAs.

4. Recommendations **for Public Policy**

4.1 Promote monitoring and inspection of secondary vegetation

Between 2014 and 2024, approximately 2.7 million hectares of secondary vegetation six years old or older were lost in the Brazilian Amazon. This loss directly compromises national restoration goals and the effectiveness of the Forest Code, representing a setback in carbon sequestration and biodiversity conservation, in addition to corresponding to an estimated restoration cost of between US$ 151 million (R$ 814 million) and US$ 6.2 billion (R$ 33 billion), depending on the strategy used. The absence of a dedicated system to monitor the suppression and recovery of these areas hinders the early identification of suppressions and the monitoring of the recovery of these areas, contributing to the continued loss of natural regeneration and compromising the fulfillment of environmental restoration goals.

It is therefore recommended to implement a real-time monitoring system, inspired by the Deter/Inpe System, adapted to capture secondary vegetation suppression. Coordination should be carried out by INPE, in conjunction with the Ministry of the Environment and Climate Change (MMA) and enforcement agencies, ensuring that the data supports strategic decisions and strengthens environmental governance in the Amazon.

4.2 Integrate fire risk from restoration into the National Policy for Integrated Fire Management

Between 2014 and 2024, approximately 325,000 hectares of secondary vegetation over six years old were directly impacted by fires, representing 12% of the total loss of this cover in the Brazilian Amazon. Despite its importance for forest restoration, the National Policy for Integrated Fire Management (PNMIF) offers explicit protection to these areas only on an ad hoc basis, through Article 46-A (Brazil, 2024). This isolated reference is insufficient given the scale of the fires and the vulnerability of areas undergoing regeneration, which highlights the need to strengthen their inclusion in fire prevention and control actions.

With this scenario in mind, it is recommended that secondary vegetation be explicitly prioritized as a target of fire prevention and control strategies in action plans derived from the PNMIF. This implies directing resources, teams, and brigade efforts to protect these areas, ensuring that natural and assisted regeneration is not compromised by new fire events.

Coordinating this measure should be the responsibility of the Ministry of the Environment and Climate Change (MMA), with operational execution by Ibama/Prevfogo and implementation coordinated by the states of the Brazilian Amazon, so as to ensure territorial integration and effectiveness in applying the policy. This approach will transform existing legal protection into practical effectiveness, increasing the resilience of restored areas and consolidating progress towards fire management aligned with restoration and Amazonian sustainability.

4.3 Implement local economic incentives linked to the protection of restored areas

According to Guimarães et al. (2024), approximately 1.67 million hectares of secondary vegetation in the Amazon biome are located in areas with high agricultural potential, 76.7% of which are on private properties and settlements, where the opportunity cost of maintaining secondary growth is high. Considering only the year 2024, we found that 55% of the vegetation removed (~37,600 hectares) had low potential for agriculture, while 45% (about 31,000 hectares) had high potential. This scenario shows that a significant portion of vegetation loss occurs precisely in areas of greater economic value for agricultural production, which reinforces the need for financial instruments that adequately compensate for these

costs. Studies indicate that a carbon price above US$ 20/tCO_2 would make restoration more profitable than cattle ranching (Assunção and Scheinkman, 2023). Without financial compensation that can compete with income from commodities, producers will have an economic incentive to convert these areas, making restoration unfeasible.

In light of this scenario, it is recommended, within the scope of the Federal Program for Payment for Environmental Services (PFPSA), to structure and implement financial compensation modalities that are competitive with agricultural income, especially in areas with high agricultural potential. This includes defining official valuation methodologies that consider the opportunity cost of land and developing communication strategies to publicize the economic benefits of the PSA to producers, encouraging them to join the program.

Implementation should be coordinated by the Ministry of the Environment and Climate Change (MMA), which manages the PNPSA, in conjunction with the Ministry of Agriculture (Mapa) to ensure correct agricultural valuation. These incentives will reduce the conversion of vegetation to agricultural activities, increasing the effectiveness of restoration policies and promoting long-term economic and environmental gains.

4.4 Designate Public Areas Not Intended for Use for Conservation

According to Guimarães et al. (2024), in 2023, 1.3 million hectares of secondary vegetation were located in Undesignated Public Areas and Land Tenure Gaps. In addition, the same study identified that 6.5 million hectares of deforested areas in Undesignated Public Areas and Land Tenure Gaps had low potential. In 2024, land tenure gaps accounted for approximately 5.3% of lost secondary vegetation, while undesignated public areas accounted for about 0.1% of this total. Although the relative proportion is smaller compared to other territorial classes, these territories are highly relevant for conservation. The designation of these areas for conservation is crucial to contain the expansion of new economically unviable deforestation, ensure the permanent protection of environmental assets, and strengthen land governance in the region.

Considering this context, it is recommended to allocate Undesignated Public Areas and Land Tenure Gap areas for the creation of Conservation Units, using the Conservation Unit (UC) as a legal instrument to ensure effective protection of these areas and consolidate ecosystem conservation. Implementation should be coordinated by the Ministry of the Environment

and Climate Change (MMA) and state governments, with technical support from ICMBio and state environmental secretariats, including studies, subsidies, and management of federal and state conservation units. This strategy will allow for more efficient protection of secondary vegetation, reduce vulnerability to new deforestation, and strengthen environmental and land governance in the Amazon.

4.5 Promote Concessions for Forest Restoration on Public Lands

Guimarães et al. (2024) identified 3.4 million hectares of deforested areas without any secondary vegetation cover within Protected Areas, such as Indigenous Lands, Military Areas, and Conservation Units (except APAs). Furthermore, in 2024, Protected Areas accounted for approximately 2.3% of secondary vegetation loss, while Environmental Protection Areas (APAs) accounted for 1.4% and Quilombola Lands for about 0.1%. These data show that, although the loss of secondary vegetation in Protected Areas represents a smaller fraction of the total, its environmental impact is significant**,** as it compromises the ecological integrity of territories legally designated for forest conservation and protection.

From this perspective, it is recommended to expand and strengthen the forest concession model, regulated by the Public Forest Management Law (Brazil, 2006), as a strategic mechanism for the restoration of degraded public lands. Under this model, private companies carry out forest planting, assume responsibility for the conservation of the area and the costs of restoration, and are remunerated through the sale of carbon credits. This instrument combines environmental preservation, the generation of socioeconomic benefits, and the strengthening of governance in Protected Areas and their surroundings.

Implementation should be coordinated by the Brazilian Forest Service (SFB), which is responsible for issuing public notices and managing contracts, and should be in coordination with the MMA and state environmental agencies to identify priority areas. This model allows for attracting private investment and distributing risks and benefits, all of which can enable the effective recovery of degraded areas on public lands.

4.6 Prioritize Environmental Regularization

Guimarães et al. (2024) identified, in 2023, 4.04 million hectares of secondary vegetation in areas of low agricultural potential in the Amazon, with 60% (2.4 million hectares) located on Private Properties (Sigef), Rural Settlements, and Areas with CAR**.** In 2024, the lost secondary vegetation was concentrated in these three territorial classes: Sigef Private Properties (60.3%), Areas with Rural Environmental Registration (CAR) (16.8%), and Rural Settlements (13.7%). These data show that private areas and settlements account for most of both the remaining vegetation and recent losses**,** reinforcing the importance of accelerating the analysis and validation of CAR and Environmental Regularization Programs (PRA) for these regions.

Prioritization in environmental regularization should focus on mesoregions that have the highest concentration of secondary vegetation with low agricultural potential**,** such as, for example, in the state of Pará, Southeast Pará (30.5%), northeastern Pará (26.3%), and the Lower Amazon (23.6%), which together account for 80.4% of these areas in the state (Guimarães et al., 2024). This strategy accelerates the effective implementation of Environmental Regularization Programs in the states and allows efforts to be concentrated where competition for land use is lower**,** which can optimize public resources and maximize economies of scale in recovering environmental liabilities.

It is recommended to prioritize these actions in areas of secondary vegetation with low agricultural potential, starting with the 2.4 million hectares located on private properties, rural settlements, and areas with CAR, with special attention to mesoregions with the highest concentration—such as, for example, in the state of Pará, the focus should be on the Southeast Paraense (30.5%), Northeast Paraense (26.3%), and Lower Amazon (23.6%) mesoregions, which together account for 80.4% of these areas in the state. This strategy allows efforts to be concentrated where pressure for land use is lower, optimizes public resources, and increases the effectiveness of environmental liability recovery.

Implementation should be coordinated by state environmental agencies (such as SEMAS, IMAC, IPAAM), in conjunction with the Ministry of the Environment (MMA) to define national guidelines. This prioritization accelerates effective environmental regularization, strengthens territorial governance, and maximizes gains in the restoration of secondary vegetation with low agricultural potential.

5. Conclusion

The identification of 5.7 million hectares of secondary vegetation over six years old highlights the fact that there is enormous potential for boosting forest restoration in the Amazon and consolidating Brazil as a global leader in nature-based solutions. However, these areas remain under severe pressure; between 2014 and 2024, 2.7 million hectares of secondary vegetation (six years old or older) were lost. Our calculations indicate that recovering this area would require investments of between US$151 million (R$814 million) in a natural regeneration scenario and US$6.2 billion (R$33 billion) if seedlings need to be planted.

The 30th Conference of the Parties (COP 30) — the United Nations Climate Change Conference — in the Brazilian Amazon (in Belém, in the state of Pará) represents a historic opportunity to transform this potential into concrete results achieved through forest restoration, integrating land use policies, economic incentives, and environmental governance. We therefore propose policies aimed at protecting and containing the suppression of areas in advanced regeneration, especially when these have low agricultural suitability. Achieving these goals requires coordinated action between governments, the productive sector, and civil society, as well as a strategy integrated with actions to combat deforestation and forest degradation. Together, the conservation of remaining forests, the restoration of open or degraded areas, and the sustainable use of land and natural resources give Brazil the full capacity to meet its national and international commitments regarding the climate agenda.

6. Bibliography

Assunção, Juliano e José Alexandre Scheinkman. 2023. Carbono e o Destino da Amazônia. Amazônia 2030. Belém, Brasil. https://amazonia2030.org.br/wp-content/uploads/2023/09/Carbono-e-o-destino-da-Amazonia.pdf.

Brancalion, Pedro H. S., Paula Meli, Julio R. C. Tymus, Felipe E. B. Lenti, Rubens M. Benini, Ana Paula M. Silva, Ingo Isernhagen, Karen D. Holl. 2019. *What makes ecosystem restoration expensive? A systematic cost assessment of projects in Brazil*. Biological Conservation, 240:108274. https://www.sciencedirect.com/science/article/abs/pii/S0006320719301934

Brandão, Amintas, Lisa Rausch, América Paz Durán, Ciniro Costa, Seth A. Spawn, and Holly K. Gibbs. 2020. "Estimating the Potential for Conservation and Farming in the Amazon and Cerrado under Four Policy Scenarios." Sustainability (Switzerland) 12 (1277): 1–22. https://doi.org/10.3390/su12031277.

Brasil. 2006. Lei Nº 11.284, de 02 de Março de 2006. Dispõe sobre a gestão de florestas públicas para a produção sustentável; institui, na estrutura do Ministério do Meio Ambiente, o Serviço Florestal Brasileiro - SFB; cria o Fundo Nacional de Desenvolvimento Florestal - FNDF.

———. 2012. Lei Nº 12.651, de 25 de Maio de 2012. Dispõe Sobre a Proteção Da Vegetação Nativa.

———. 2000. Lei Nº 9.985, de 18 de Julho de 2000. Institui o Sistema Nacional de Unidades de Conservação Da Natureza e Dá Outras Providências.

———. 2024. Lei Nº 14.944, de 31 de Julho de 2024. Institui a Política Nacional de Manejo Integrado do Fogo.

———. 2025. Governo do Brasil anuncia aporte de R$ 126 milhões do Fundo Amazônia para restauração de florestas. Secretaria de Comunicação Social. Brasília, 16 out. 2025. https://www.gov.br/secom/pt-br/assuntos noticias/2025/10/governo-do-brasil-anuncia-aporte-de-r-126-milhoes-do-fundo-amazonia-para-restauracao-de-florestas.

Fundação Getulio Vargas (FGV). 2025. FGV Dados: Atualização Monetária de Valor - Índice Geral de Preços - Mercado (IGP-M). https://extra-ibre.fgv.br/IBRE/sitefgvdados/default.aspx

Guimarães, Jayne, Paulo Amaral, Andréia Pinto, Rodney Salomão. 2024. *A vocação da restauração florestal na Amazônia com base na vegetação secundária*. Belém e São Paulo: Amazônia 2030. https://imazon.org.br/publicacoes/a-vocacao-da-restauracao-florestal-na-amazonia-com-base-na-vegetacao-secundaria/

Instituto de Pesquisa Econômica Aplicada (IPEADATA). 2025. Taxa de Câmbio Dólar Comercial para Compra - Média (GM366_ERC366). https://www.ipeadata.gov.br/ExibeSerie.aspx?stub=1&serid=38590&module=M

Instituto do Homem e Meio Ambiente da Amazônia (IMAZON). 2024. Banco de Dados de Vegetação Secundária 2023 no Bioma Amazônia - Sistema FloreSer. projects/imazon-simex/FLORESER/floreser-collection-9-22-1-ages-sf.

Instituto Nacional de Pesquisas Espaciais (INPE). 2024. "Nota Técnica: Evento de Lançamento dos Novos Resultados do TerraClass Amazônia e Cerrado." https://linktr.ee/terraclass.

MapBiomas Brasil. 2025. Plataforma de Mapas e Dados: Coleção de Mapas de Uso e Cobertura do Solo do Brasil. https://brasil.mapbiomas.org/

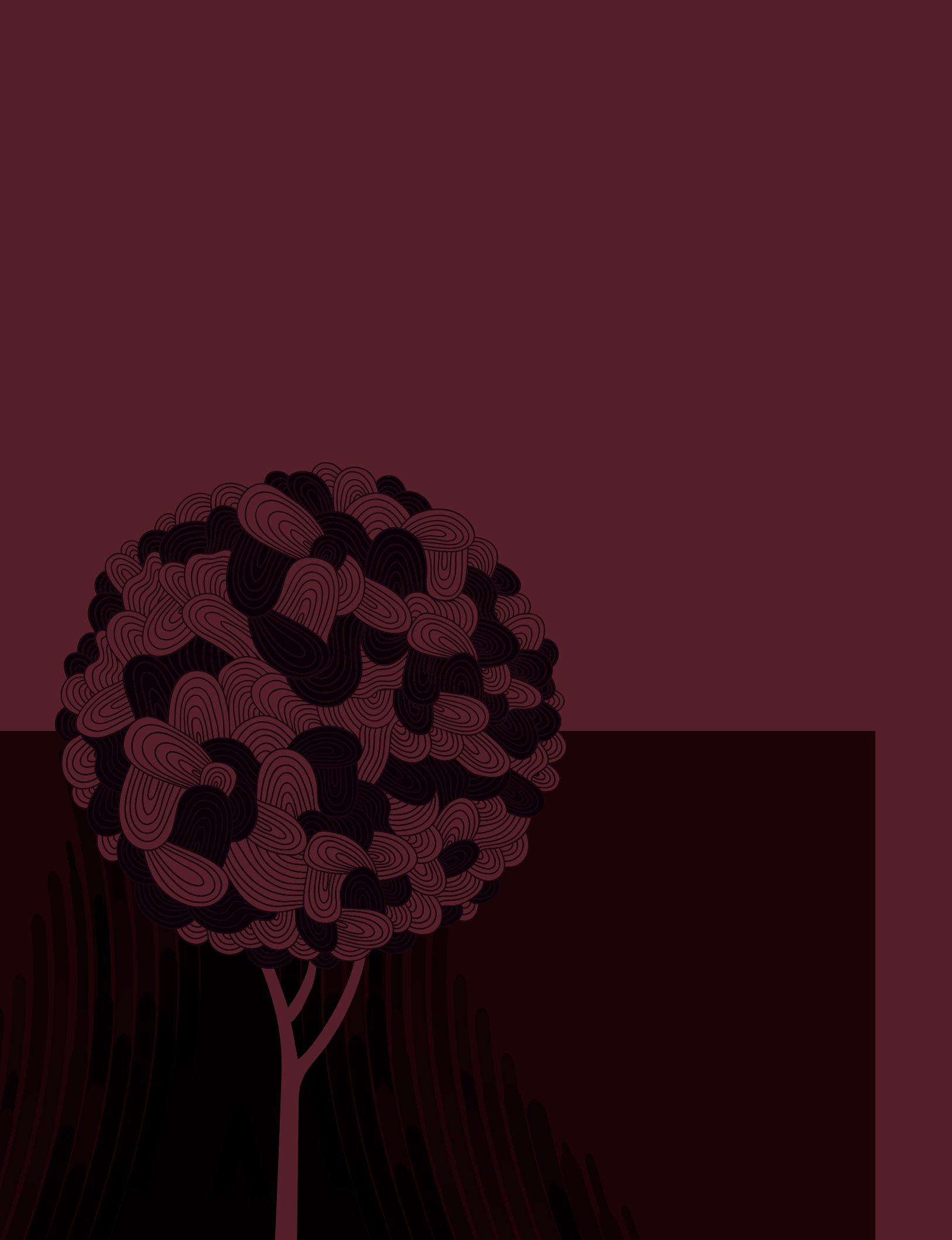
Ministério do Meio Ambiente e Mudança do Clima (MMA). Departamento de Florestas, Secretaria de Biodiversidade, Florestas e Direitos Animais (DFLO/SBIO). 2024a. Plano Nacional de Recuperação da Vegetação Nativa (PLANAVEG) 2025 - 2028. Brasília: MMA. https://www.gov.br/mma/pt-br/ composicao/sbio/dflo/plano-nacional-de-recuperacao-da-vegetacao-nativa-planaveg/planaveg_2025-2028_2dez2024.pdf.

Ministério do Meio Ambiente e Mudança do Clima (MMA). 2024b. A NDC DO BRASIL: Determinação nacional em contribuir e transformar. Brasília: MMA. https://www.gov.br/mma/pt-br/assuntos/noticias/brasil-entrega-a-onu-nova-ndc-alinhada-ao-acordo-de-paris/ndc-versao-em-portugues.pdf/

Oliveira, Mariana, Bruno Calixto. 2020. Desafio de Bonn: as iniciativas que contribuem para o Brasil se tornar líder na restauração. São Paulo: World Resources Institute (WRI) Brasil. https://www.wribrasil.org.br/noticias/desafio-de-bonn-iniciativas-que-contribuem-para-o-brasil-se-tornar-lider-na-restauracao.

Pinto, Andréia, Paulo Amaral, Rodney Salomão, Luís Oliveira Jr, Carlos Alexandre da Cunha e Lucas Figueiredo. 2021. “Restauração Florestal Em Larga Escala Na Amazônia: O Potencial Da Vegetação Secundária,” 27. https://amazonia2030.org.br/wp-content/uploads/2021/04/Restauracao-Florestal-AMZ-2030.pdf.

Souza-Jr, Carlos M., Luis A. Oliveira, Jailson S. de Souza Filho, Bruno G. Ferreira, Antônio V. Fonseca e João V. Siqueira. 2023. Landsat sub-pixel land cover dynamics in the Brazilian Amazon. Front. For. Glob. Change 6: 1294552. doi: 10.3389/gc.2023.129455



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