


THE NEW CARBON MARKET AND THE BRAZILIAN AMAZON FOREST

POLICY BRIEF



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Funding provided by Shell, Roger Sant, Grantham Foundation and the Rockefeller Brothers Fund.

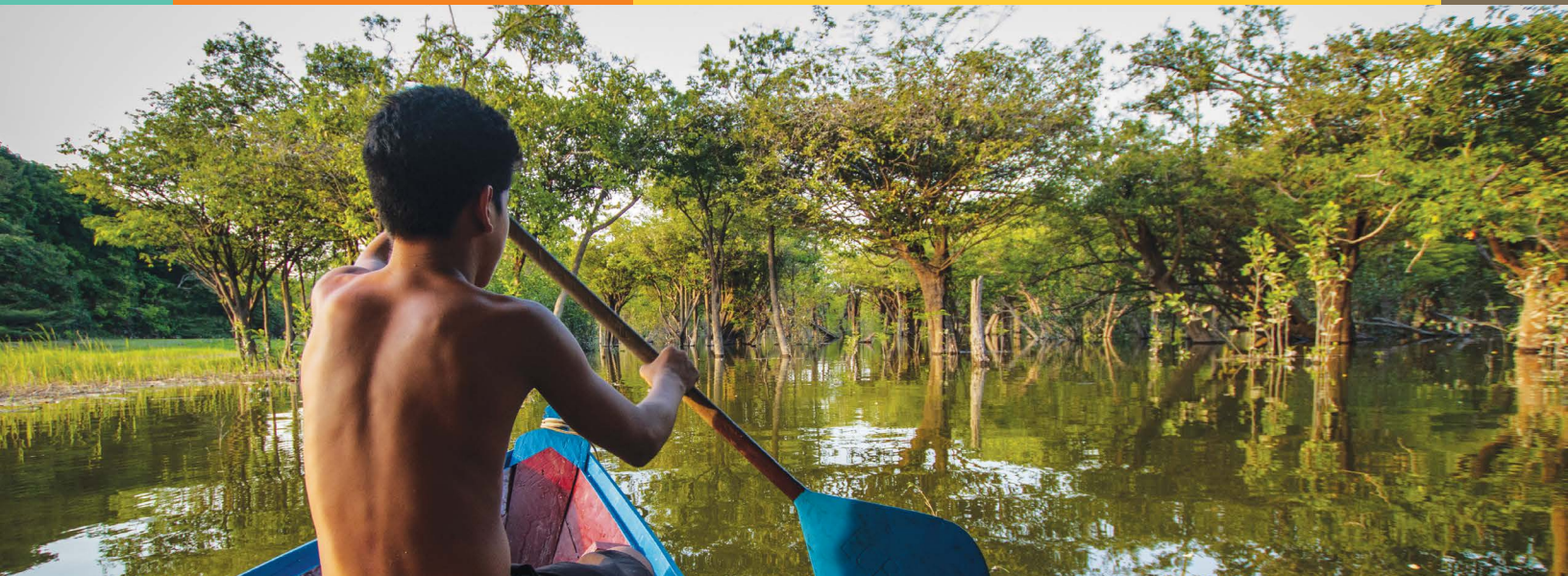
TECHNICAL ASSISTANCE | David “Toby” McGrath and Bjørn Rask Thomsen made important suggestions for the report. Dr. Carolina DeBeux (Universidade Federal do Rio de Janeiro, COPPE) provided important guidance on the analysis of future emissions in Brazil conducted by Instituto Talanoa and COPPE; the MapBiomas Initiative and INPE/PRODES were sources of the forest carbon and land use change data used in this study.

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MAIN CONCLUSIONS

- **The new carbon market has arrived and is seeking sellers.** Many companies are seeking high-quality credits to make progress towards their “net zero” emissions climate commitments. Some of the biggest buyers are turning to the states of the Brazilian Amazon to buy forest carbon credits that could soon be provided by “jurisdictional REDD+” (J-REDD+) programs for driving state-wide transitions to forest- and carbon-positive development. The demand and price for high-quality credits are likely to grow considerably as the Paris Article 6 framework and other market mechanisms (e.g. civil aviation’s carbon offset program) become operational.
- **Brazil could receive 13 to 48 billion dollars by 2030** through the sale of high-quality forest carbon credits from J-REDD+ programs of the Amazon states. This represents an unprecedented opportunity to finance the Amazon’s transition to a vibrant, forest- and carbon-positive, socially-inclusive economy, securing the region’s rainfall system and reducing the likelihood of a large-scale forest dieback in the future.
- **The states will have credits to sell only if they succeed in reversing the trend of rising emissions** from Amazon deforestation and forest degradation that has prevailed for the last ten years while expanding the region’s 16 million hectares of secondary forests. If a 90% reduction in these emissions¹ is achieved by 2030, approximately 2.5 to 2.6 billion tonnes of CO₂ emissions reductions would be available to sell as credits according to the rules of three international standards for jurisdictional REDD+ (JNR, ART/TREES, California TFS²); following discounts for leakage, permanence and uncertainty risks, this volume would represent 13 to 48 billion US dollars for credit prices ranging from \$10 to \$30 per tonne CO₂. The Brazilian Amazon forest would go from a 0.7 GtCO₂/year source (2020) to a 0.2 GtCO₂/yr sink.
- **This scenario is plausible because of the important co-benefits that a pivot to forest- and carbon-positive development in the Amazon would likely confer**, including better access to international markets and foreign investment, a return to the front of the global race to net zero, and the ability to sell high-value credits with corresponding adjustments.

1 We analyzed a scenario of 90% reduction in emissions from primary and secondary deforestation and forest degradation (logging, forest fire) by 2030 compared to a baseline period of 2001-2010 (deforestation) and 2007 (degradation).

2 Jurisdictional Nested REDD+ standard (JNR), the Architecture for REDD+ Transactions/The REDD+ Environmental Excellence Standard (ART/TREES) and the California Tropical Forest Standard (TFS)

- ***This scenario is also plausible because carbon revenues could provide the positive incentives for forest conservation that were largely missing from Brazil’s massive “PPCDAm” program*** of punitive measures and protected area creation that drove Amazon deforestation rates down nearly 80% from 2005 to 2012. With these revenues, long-awaited investments and incentives could flow to forest-conserving communities and farmers at the scale that is needed, alleviating rural poverty and rewarding those who forgo their legal right to clear; carbon sales could provide start-up funding for new low-carbon bio-economies and bolster law-enforcement programs.
- ***To sell credits, the states must recognize and respect the rights of indigenous peoples and local communities.*** To this end, all nine states of the Brazilian Amazon have already made this commitment by signing the guiding principles of collaboration that are endorsed by major indigenous peoples’ organizations.
- ***Some states (e.g. Acre, Mato Grosso) have already established J-REDD+ programs that are supporting indigenous peoples and giving them a seat at the public policy table.*** The jurisdictional REDD+ programs of these states have established multi-sector governance structures, benefit-sharing agreements, legal frameworks, and monitoring systems.
- ***To complete and implement their programs, the states need upfront finance.*** The Brazilian state REDD+ programs have been starved for funding. Only 4% of the emissions reductions achieved since 2004 have been compensated. New results-based-payment contracts and advance purchase agreements for future credits are the most promising mechanisms for delivering this finance.
- ***The sale of credits by states must be authorized by the federal government.*** Once this permission is granted, additional steps must be taken to complete Brazil’s forest carbon monetization system. The new Brazilian forest reference level—the baseline for measuring emissions reductions—must be completed and reconciled with the state-level baselines determined using international REDD+ standards. A national emissions reduction registry and trading system—such as that now under consideration by the Brazilian Congress (pending bills 528/2021 and 2158/2022)—should be implemented to avoid double counting and support a domestic emissions reduction trading system.
- ***The new carbon market will pay a premium for credits with “corresponding adjustments”, that is credits for emissions reductions that are above and beyond the targets established through Brazil’s “nationally-determined contribution” (NDC) to the Paris climate agreement;*** declining emissions from Amazon forests put deep economy-wide emissions reductions within reach.
- To fully participate in the new carbon economy, ***Brazil will need a comprehensive, sector-specific strategy for driving the transition to carbon neutrality***, a greenhouse gas inventory program that provides annual assessments with far more detail about the emissions of individual sectors and entities, and greater alignment of public policies around the decarbonization agenda.

THE NEW CARBON MARKET

We are at the threshold of a new carbon market (Figure 1). Growing global concern about the climate crisis among voters and consumers is driving nations, cities and companies to make “net zero” carbon emissions commitments. More than 5000 businesses have joined the “Race to Zero” alliance, for example, and many of these companies are counting on the purchase of carbon credits as part of their strategies for achieving net zero, driving demand upward.

Reinforcing this rise in demand for carbon credits is the promise of a new global framework for transactions of emissions reductions between nations or between businesses. The final rules of the Paris climate agreement “Article 6” framework were decided at the last UN climate summit, in Glasgow. The “Carbon Offset and Reduction Scheme of International Aviation” (CORSIA) is another major new driver of demand for credit soon to become operational.

THE NEW CARBON MARKET FOR TROPICAL FORESTS

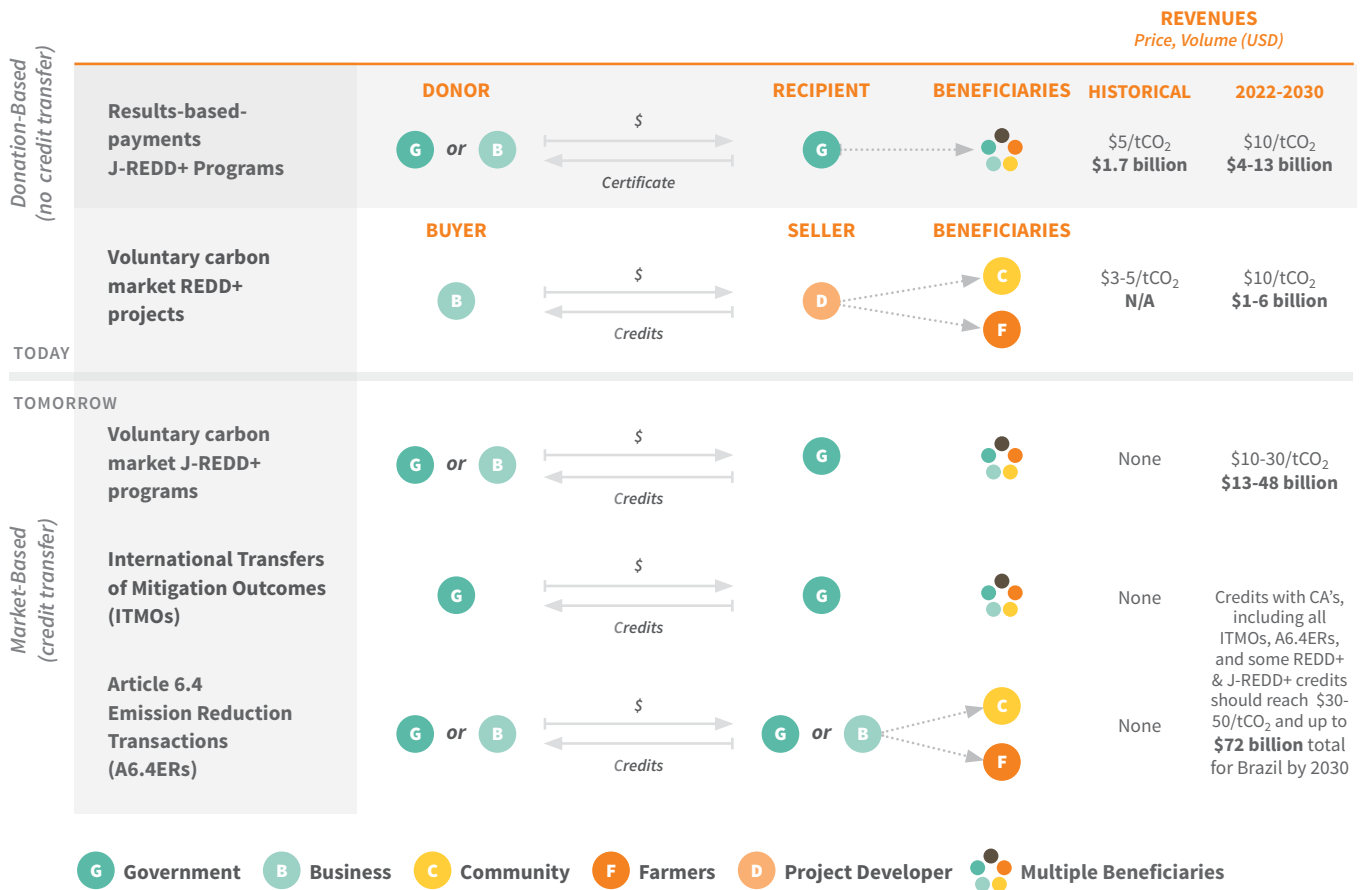


FIGURE 1. The new carbon market will feature three new types of forest carbon transactions: jurisdictional REDD+ credits, international transfer of mitigation outcomes (ITMOs) and Article 6.4 emissions reduction transactions. Prices for credits with corresponding adjustments (\$30-50/tCO₂) will be far higher than prices for voluntary carbon market credits without corresponding adjustments (\$10/tCO₂). Current forest carbon monetization mechanisms will continue. Source: estimate for Voluntary carbon market J-REDD+ programs is from this study; other sources available upon request.

The Glasgow decisions on Article 6 of the Paris Agreement set the stage for two new international market mechanisms for forest carbon transactions among nations or between nations and private sector actors. These mechanisms should become operational over the next two to three years, greatly increasing the scale of forest carbon transactions. The first will operate via a centralized mechanism, with bilateral transactions of what are called “Internationally Transferred Mitigation Outcomes” (ITMO’s) between nations. The second mechanism, described in Article 6.4 of the Paris Agreement, will operate via a decentralized mechanism, with transactions of Emission Reductions, called “A6.4ERs”, taking place between public and private entities.

Forest carbon financial transactions to date have been relatively small in scale, channeled largely through “results-based-payment” donations (such as the Amazon Fund and “REDD+ for Early Movers” program) recognized under Article 5 of the Paris agreement and through business-to-business sales of credits from forest carbon projects in the voluntary market (Figure 1). Brazil has been a major player in these early forest carbon transactions, capturing US\$1.6 billion in “results-based-payments” at the federal and state level since 2009. Compliance markets do not yet allow credits from tropical forest regions to count as offsets. The California cap-and-trade program was designed to recognize forest carbon offsets from jurisdictional REDD+ programs and has approved the California Tropical Forest Standard in preparation for those transactions, but has yet to regulate its international offset program.

Forest carbon credits are the main type of credit sold today in the voluntary carbon market, which grew from annual financial transactions of forest carbon credits of USD 159 M in 2019 to 544 M from January to August, 2021, an increase of 242%.³ Concern about the quality of these credits, for example the issue of overstating the real emissions reductions that these projects deliver⁴, has caused some of the largest buyers of forest carbon⁵ credits and a coalition of companies and governments to seek “jurisdictional REDD+” credits—credits from comprehensive, multi-sector programs that achieve large-scale forest carbon emissions reductions across entire states and provinces⁶. Brazilian states could soon provide a large volume of certified J-REDD+ credits to these buyers. Today, there are no J-REDD+ credits available.

3 Forest Trends' Ecosystem Marketplace. 2021. 'Market in Motion'; State of Voluntary Carbon Markets 2021, Installment 1. Washington DC: Forest Trends Association.

4 West, T. et al. 2020. Overstated carbon emission reductions from voluntary REDD+ projects in the Brazilian Amazon. Proceedings of the National Academy of Sciences Sep 2020, 117 (39) 24188-24194; DOI: 10.1073/pnas.2004334117.

5 Several companies are each seeking 10s to up to 100 MtCO₂ per year in J-REDD+ credits.

6 Nepstad, D., W. Boyd, C. Stickler, T. Bezerra, A. Azevedo. 2013. Responding to climate change and the global land crisis: REDD+, market transformation and low-emissions rural development. Phil. Trans. Roy. Society B. <https://doi.org/10.1098/rstb.2012.0167>



THE OPPORTUNITY FOR THE BRAZILIAN AMAZON

This new carbon market is an unprecedented opportunity to provide finance at the scale and speed that is needed for the Amazon to make the transition to equitable, poverty-alleviating, forest-friendly development. This finance could strengthen and replicate existing state-wide programs that are delivering benefits to indigenous peoples, farmers, and other rural communities, as it provides start-up funding for sustainable enterprises and new bio-economies; it could also bolster the state law enforcement programs which are, collectively, far larger than the federal government's law enforcement program.

In this Policy Brief, we take a close look at this opportunity. We conclude that the “jurisdictional REDD+” programs of Brazil's Amazon states could generate \$13 billion to \$48 billion dollars by 2030 through the sale of forest carbon credits if emissions decline 90%. The pivot to forest- and carbon-positive emissions would confer major benefits to the Brazilian and Amazon economies.

THE SCENARIO

a pivot to socially-inclusive, forest- and carbon-positive development in the Brazilian Amazon

In this study, we examine a scenario in which deforestation of both primary and secondary Amazon forests and forest degradation through logging and fire decline 90% by 2030 relative to their historical values (Figure 2). We also assume that the 16 million hectares of secondary forest in the region today will expand at an accelerated rate because of the decline in secondary forest clearing, and that the ca. 5.5 million hectares of forest that must be restored on private farms to comply with the Forest Code⁷ would take place by 2030. When we add together emissions reductions and the increase in carbon removals by secondary forests and newly-restored forests, the Amazon forest shifts from a net source of roughly 0.7 GtCO₂ (billion tonnes of CO₂) emissions today to a net sink of 0.18 GtCO₂ in 2030 (Figure 2). This estimate does not include the net uptake of CO₂ by intact primary forests.

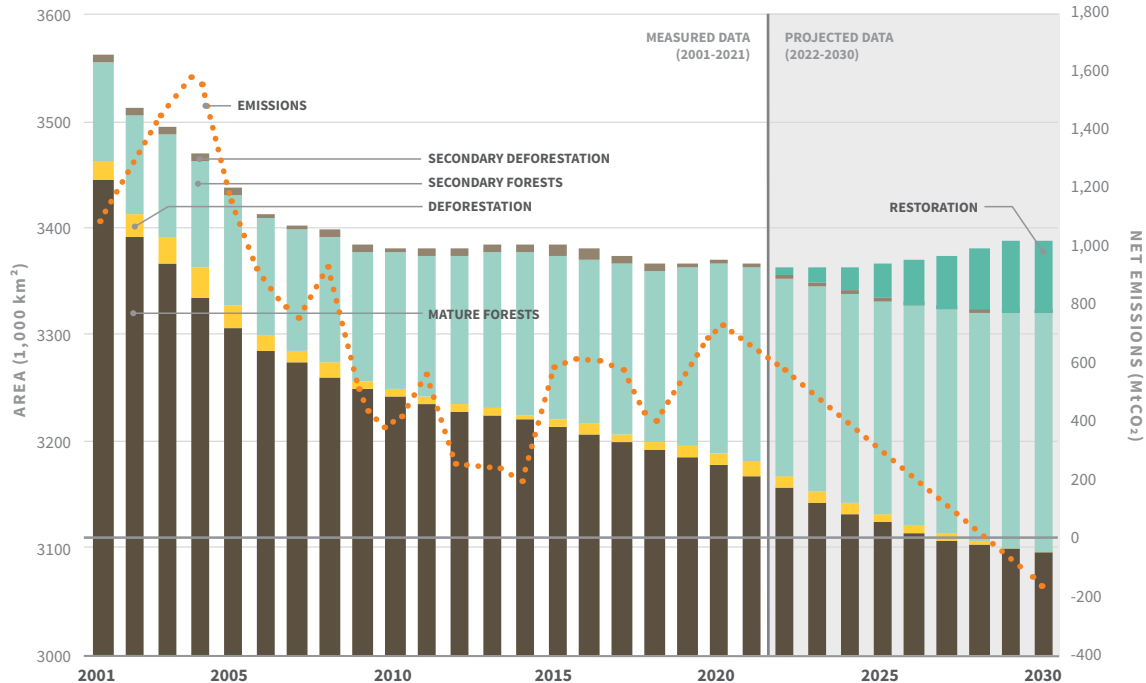


FIGURE 2. The Brazilian Amazon forest scenario analyzed in this study. Total forest area and net emissions from deforestation, forest degradation and carbon dioxide removals by secondary forests and newly-restored forests. The figure is based on forest measurements from 2001 through 2021 and projections for 2022 through 2030. The scenario assumes that primary and secondary deforestation decline to 10% of their historical values (average of 2001-2010) by 2030. Carbon removals by an expanding area of secondary forest and restored forests are estimated at 10 tCO₂/ha/year. Forest degradation is not illustrated in the forest area columns, but is included in the net emissions estimate. It is the largest source of anthropogenic carbon dioxide emissions from Amazon forests today⁸, and is assumed to decline to 10% of its historical value (2007). Data sources: INPE/PRODES 2022 (primary deforestation), DEGRAD and DETER (forest degradation), and secondary forest area, secondary deforestation, and new areas of secondary forest (MapBiomass 2022).

⁷ Based on assessment of 945,000 CAR applications from the Amazon forest biome submitted to SISCAR in 2021.

⁸ Qin, Y., Xiao, X., Wigneron, J.P., Ciais, P., Brandt, M., Fan, L., Li, X., Crowell, S., Wu, X., Doughty, R. and Zhang, Y., 2021. Carbon loss from forest degradation exceeds that from deforestation in the Brazilian Amazon. *Nature Climate Change*, 11(5), pp.442-448.

The 90% reduction assumption is less ambitious than the zero deforestation target for 2030 stated in the Glasgow Leaders' Declaration on Forests and Land Use to “halt and reverse forest loss and land degradation by 2030”, to which Brazil is a signatory. The 5.5 M hectare forest restoration goal by 2030 is in line with the 12 M hectare nation-wide goal for 2030 in Brazil's first NDC.

International standards for J-REDD+ including the JNR, ART/TREES, or California Tropical Forest Standard², are quite conservative in their rules for estimating the volume of credits that result from avoided emissions or additional removals. Discounts are made for possible leakage of emissions outside of the target jurisdiction, performance reversals, and measurement uncertainties⁹. The standards are also not forward-looking. That is, they do not consider, for example, that emissions from forest degradation are likely to increase as climate change progresses and severe droughts and forest fire become more common.^{10,11} For the scenario chosen, we estimate the volume of carbon emissions reductions that could qualify as verified credits under the rules for these international standards for jurisdictional REDD+.

Is a 90% reduction in Amazon deforestation and forest degradation and net carbon uptake by 2030 plausible when the rate of forest loss has nearly tripled in the last decade and when the current administration of Brazil has reduced the government's environmental law enforcement capacity and is striving to open indigenous lands to mining? We summarize here the reasons we believe it is.

9 Eligibility requirements for REDD+ financing. https://www.nature.org/content/dam/tnc/nature/en/documents/EligibilityRequirementsforREDDPlus_Financing_2021.pdf

10 Duffy, P.B., Brando, P., Asner, G.P. and Field, C.B., 2015. Projections of future meteorological drought and wet periods in the Amazon. *Proceedings of the National Academy of Sciences*, 112(43), pp.13172-13177.

11 Brando, P.M., Soares-Filho, B., Rodrigues, L., Assunção, A., Morton, D., Tuchsneider, D., Fernandes, E.C.M., Macedo, M.N., Oliveira, U. and Coe, M.T., 2020. The gathering firestorm in southern Amazonia. *Science advances*, 6(2), p.eaay1632.

IS THE FOREST- AND CARBON-POSITIVE SCENARIO PLAUSIBLE?

1. The legal and regulatory framework is in place.

Brazil has taken extraordinary steps to formally protect the forests of its Amazon region (Figure 3). The challenge of reducing deforestation and forest degradation in the region is, at one level, one of implementation—of putting forest designations and regulations into practice and completing the formal designation process for forests that remain undesignated.

Carbon credit finance at the scale that is possible through the new carbon market represents an unprecedented opportunity and financial motive for the federal government, state governments and farm and timber sectors to recognize and implement forest designations and regulations. Currently, the economics of land-use systems in the Amazon region do not favor forest conservation. In the private land market of Amazon agricultural regions, cleared land is worth far more than forested land¹².

Eighty-one percent of the original forest cover of the Brazilian Amazon is still standing¹³. Land designations and regulations fully implemented would provide protection to 94% of these remaining forests, which is 74% of the original forest area (Figure 3, Table 1). Most forests are located in indigenous territories (24%) followed by federal protected areas (19%, parks, nature reserves, national forests), state protected areas (11%) and private lands (17%). Nine percent of the forests are undesignated.

All public forest lands have seen rising deforestation rates in recent years.^{14,15} Funding is needed to support indigenous peoples and governmental law enforcement programs to defend indigenous territories, to defend and manage state and federal protected areas (few have management committees and management plans, for example), and to expand fire brigades and voluntary networks for the early detection and control of forest fires.

FOREST CATEGORY	FOREST AREA (M HA)	PERCENT OF REMAINING FOREST	PERCENT OF ORIGINAL FOREST
Private (CAR)	70	21.6	17.5
Protected, State	44	13.6	11.0
Protected, Federal	78	24.0	19.4
Indigenous Territories	97	30.0	24.3
Undesignated	35	10.8	8.8
TOTAL	324	100	81

TABLE 1. Land designations and regulatory forest protection on private land in the Brazilian Amazon forest biome. “CAR” refers to the Cadastro Ambiental Rural, an instrument for monitoring compliance with the Brazilian Forest Code. Protected areas include state and national parks, nature reserves, state and national forests, extractive reserves, and other types of sustainable use reserves. Data sources: SICAR, Serviço Florestal Brasileiro, available online: <https://www.car.gov.br/publico/imoveis/index> (accessed March 10, 2022); Instituto Chico Mendes de Conservação, Ministério do Meio Ambiente, available online: <https://www.icmbio.gov.br/portal/> (accessed March 10, 2022).

12 Latin American and Caribbean Forests in the 2020s: Trends, Challenges, and Opportunities. Nepstad, D. et al. Available online at: <https://publications.iadb.org/en/latin-american-and-caribbean-forests-2020s-trends-challenges-and-opportunities> (accessed March 9, 2022)

13 Nepstad, D., Nobre, C.A., Sohngen, B., Bauch, S.C., Robalino, J., Rajão, R., Nascimento, N., Finegan, B., Blackman, A. and Arieira, J., 2021. Latin American and Caribbean Forests in the 2020s: Trends, Challenges, and Opportunities. Inter-American Development Bank, IDB Monograph 864.

14 Moraes, I., Azevedo-Ramos, C. and Pacheco, J., 2021. Public Forests Under Threat in the Brazilian Amazon: Strategies for Coping Shifts in Environmental Policies and Regulations. *Frontiers in Forests and Global Change*, 4, p.45.

15 Alencar, A., I Castro, L Laureto, Ca Guyot, M. C. C. Stabile, and P. Moutinho. 2021. “Amazônia em Chamas - Desmatamento e fogo nas Florestas Públicas Não Destinadas: nota técnica no 7.” IPAM. Disponível em <https://ipam.org.br/bibliotecas/amazonia-em-chamas-7-desmatamento-e-fogo-nas-florestas-publicas-nao-destinadas/> (Accessed March 9, 2022)

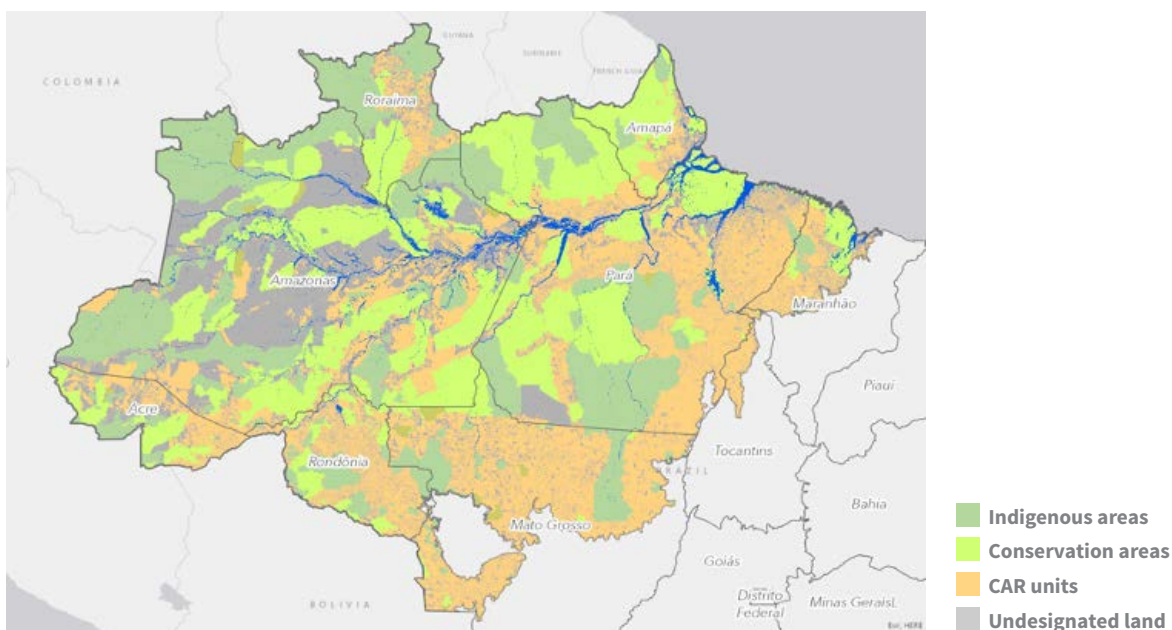


FIGURE 3. The Brazilian Amazon region land designations, Amazon forest biome. Ninety-four percent of the remaining forests (74% of the original forest) would be protected under a full legal compliance scenario. The most vulnerable forests are found on landholdings, adjacent to cattle pastures and cropland; 740,000 farm level CAR (Rural Environment Registry) applications encompass 22% of the region's remaining forests (orange). Data source: SICAR, Serviço Florestal Brasileiro, available online: <https://www.car.gov.br/publico/imoveis/index> (accessed March 3, 2022)

Most of the 70 million hectares of privately-held forests are legally protected by Brazil's Forest Code, which requires Amazon landholders to maintain 80% of their properties as a legal forest reserve called the *reserva legal*. Approximately 6.7 million hectares of these private forests could be legally cleared. Legitimate landholders who are incurring opportunity costs for not clearing these “surplus” forests are an important target for a carbon incentive that compensates for those costs. The “Cadastro Ambiental Rural” (CAR, Rural Environmental Registry) is the tool for monitoring compliance with the FC and could greatly facilitate a system of payments for surplus forests. The vast majority of the 745,000 CAR applications that have been submitted from the Amazon forest biome have yet to be validated by government agencies, a process that is impeded by the lack of broadly-accepted base maps and administrative inefficiencies. Forests on private land are particularly vulnerable to deforestation because of their close proximity to cattle pastures and crop fields.

IS THE FOREST- AND CARBON-POSITIVE SCENARIO PLAUSIBLE?

2. Social, economic and ecological co-benefits.

Full implementation and financing of the J-REDD+ programs of the states of the Brazilian Amazon *would confer major social and economic benefits* to the Amazon and to Brazil, increasing the plausibility of the scenario analyzed here. And to be clear, implementation and finance are inter-dependent: the pivot to a forest- and carbon-positive development pathway is the pre-condition for the flow of significant forest carbon finance. The prospect of these co-benefits could become the basis for multi-sector support for this pivot.

Co-benefits include:

1. *Trade and foreign investment:* A reversal of Brazil's ten-year trend of rising deforestation would, itself, confer benefits to the Brazilian economy. Rising rates of Amazon deforestation are increasingly seen as a risk of doing business with Brazil by foreign companies that buy Brazilian products and by foreign investors interested in investing in Brazil's industries and enterprises. More than 500 companies have pledged to remove tropical deforestation from their supply chains of soybeans, beef and other commodities. The European Union's policy on "imported deforestation" is considering restrictions on imports of soybeans, beef, palm oil, cocoa and other commodities whose production is associated with deforestation. Rising Amazon deforestation has been an obstacle to the ratification of the Mercosur-EU trade agreement.
2. *Climate leadership:* Brazil could re-establish itself as a global leader in the transition to a low-carbon economy, reinforcing the trade and investment benefits described in #1. With more than half of national emissions originating from deforestation and land-use (Figure 4), with relatively clean electricity and transportation sectors, and important strides made in reducing the carbon footprint of its agricultural and livestock sectors¹⁶), a pivot to forest- and carbon-positive development in the Amazon (Figure 2) could elevate Brazil's stature and reputation on the international stage.

¹⁶ For example, from 2000 to 2020 total emissions from the farm sector increased 32% (from 438 MtCO₂ to 577 MtCO₂, SEEG, 2020). In this same period, the Grosse Production Value (aggregate value of all farm sector sales of crops and livestock) increased 172% (from 320 to 871 billion BRL, MAP, IBGE, 2020). The carbon intensity of agricultural/livestock production decreased 52%.

BRAZIL'S CARBON DIOXIDE EMISSIONS AND NDC TARGETS

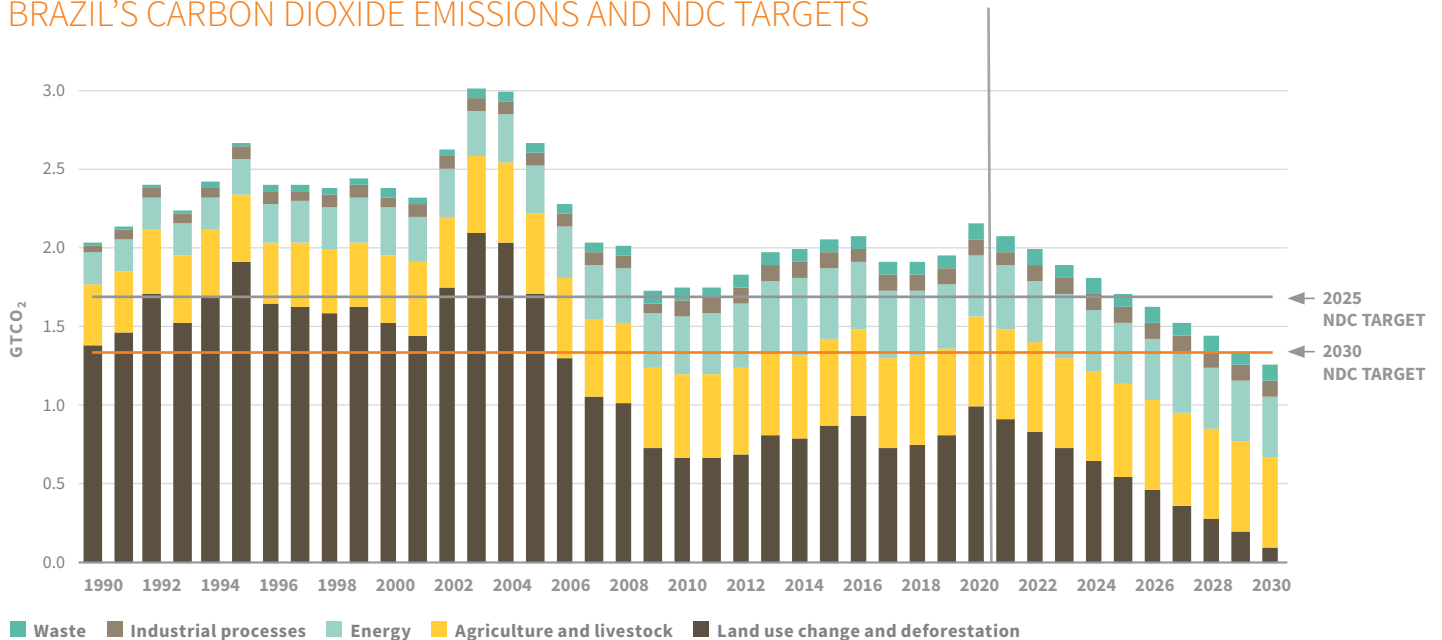


FIGURE 4. Annual emissions of carbon dioxide from the Brazilian economy and the emissions reduction targets presented by Brazil in its NDC to the Paris climate agreement. The NDC targets are a 37% reduction in emissions by 2025 and a 50% reduction by 2030 with a 2005 baseline and a net-neutral national economy by 2050. Amazon deforestation, forest degradation and secondary forest removals comprise most of Brazil's land use change and deforestation emissions. Source: SEEG 2021.

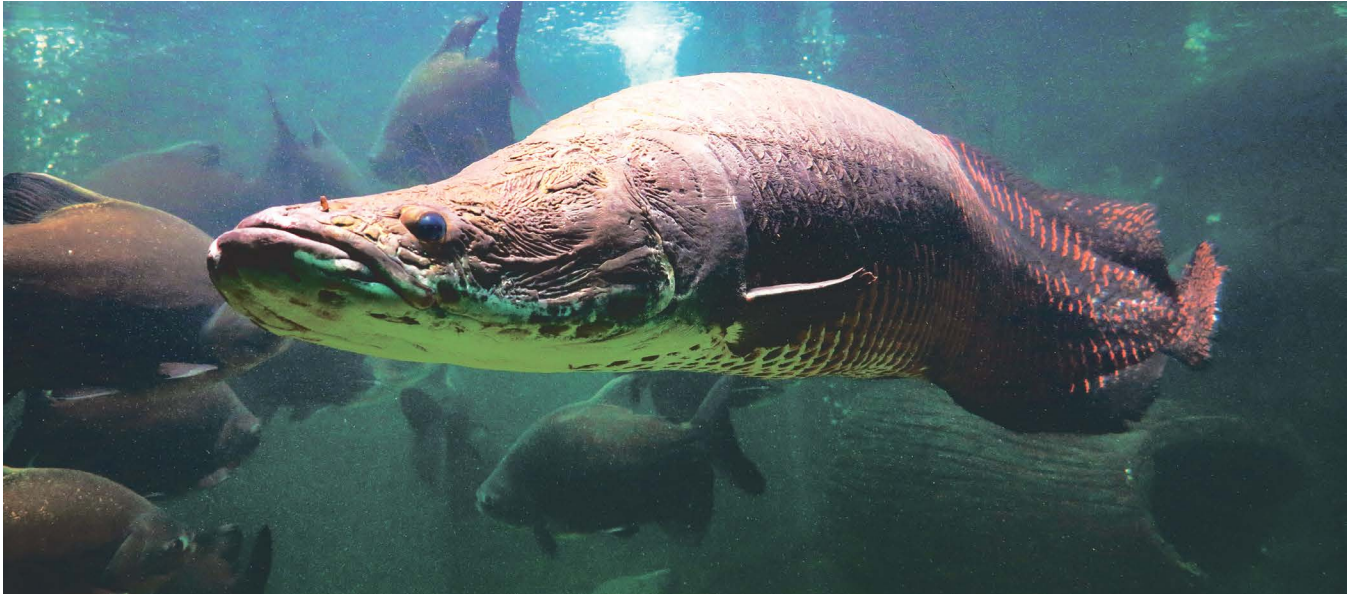
3. *The Paris Article 6 framework and credits with corresponding adjustments (CAs):* Declining nation-wide emissions would position Brazil to sell significant volumes of credits with “corresponding adjustments” (CAs) and, hence, higher market values. Credits with CAs are those representing emissions reductions that are beyond a nation’s targets established through its “nationally-determined contribution” (NDC) to the Paris climate agreement. Brazil could surpass both its 2025 target of a 37% reduction in emissions relative to its 2005 level and its 2030 NDC target of a 50% reduction in nation-wide emissions if land use and deforestation emissions decline significantly. Amazon deforestation and land use is the lion’s share of these emissions.
4. *Rainfall security in the Amazon.* Numerous scientific studies have demonstrated the partial dependence of rainfall in the Amazon region on the Amazon forest itself, beginning with the pioneering work of the late Professor Eneas Salati, in the 70’s.¹⁷ Forest loss has already contributed to longer dry seasons in the southern Amazon¹⁸; rainfall inhibition caused by Amazon forest loss could lead to a large-scale forest dieback that increases Amazon forest carbon emissions through forest fire¹⁹ or to an eventual “tipping point” beyond which rainfall is insufficient to sustain Amazon forests in some regions.²⁰ Reliable rainfall is the foundation of the Amazon economy. It is the basis for the region’s food production and its agricultural exports; it maintains the watersheds and rivers that are inter-urban transportation corridors and lifelines for isolated rural communities who depend upon river travel. When there is sufficient rainfall, intact forests act like giant firebreaks across the landscape, preventing the spread of accidental fire. When the Amazon

17 Salati, E., Dall’Olio, A., Matsui, E. and Gat, J.R., 1979. Recycling of water in the Amazon basin: an isotopic study. *Water resources research*, 15(5), pp.1250-1258.

18 Leite-Filho, A.T., Costa, M.H. and Fu, R., 2020. The southern Amazon rainy season: the role of deforestation and its interactions with large-scale mechanisms. *International Journal of Climatology*, 40(4), pp.2328-2341; Fu, R., Yin, L., Li, W., Arias, P.A., Dickinson, R.E., Huang, L., Chakraborty, S., Fernandes, K., Liebmann, B., Fisher, R. and Myneni, R.B., 2013. Increased dry-season length over southern Amazonia in recent decades and its implication for future climate projection. *Proceedings of the National Academy of Sciences*, 110(45), pp.18110-18115.

19 Nepstad, D. et al. 2008. Nepstad, D., C.M. Stickler, B. Soares-Filho, and F. Merry. Interactions among Amazon land use, forests and climate: prospects for a near-term forest tipping point. *Phil. Trans. Roy. Soc. B*. doi:10.1098/rstb.2007.0036

20 Nobre, C.A. and Borma, L.D.S., 2009. ‘Tipping points’ for the Amazon forest. *Current Opinion in Environmental Sustainability*, 1(1), pp.28-36.



experiences severe droughts such as those in 2005 and 2010, forests become vulnerable to fire, crops fail, respiratory illness and deaths spike, and rural communities are cut off from health care, markets, and schools.²¹

5. *New low-carbon economies and poverty alleviation.* A pivot to forest- and carbon-positive development in the Amazon could provide major new flows of finance for start-up funds and incubators for low-carbon enterprises and bio-economies. Aquaculture, for example, can produce a ton of animal protein on only 5% of the land area needed to grow a ton of beef; fish production from aquaculture is already one tenth the volume of the region's beef production.²²
6. *Stronger recognition of the rights of indigenous peoples and local communities.* Carbon revenues will only flow to the J-REDD+ programs of the Brazilian Amazon states if the rights of indigenous peoples and local communities are respected, if they receive a fair allocation of carbon revenues, and if they are full participants in the design and implementation of the J-REDD+ program. These are social safeguard requirements of each of the standards considered. All of the states of the Brazilian Amazon are signatories to the landmark "Guiding Principles for Collaboration between Subnational Governments, Indigenous Peoples and Local Communities", co-created and endorsed by eighteen indigenous peoples organizations, including Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica (COICA), Aliansi Masyarakat Adat Nusantara (AMAN), Alianza Mesoamericana de Pueblos y Bosques (AMPB), Organización Nacional de los Pueblos Indígenas de la Amazonia Colombiana (OPIAC), Federação dos Povos Indígenas de Mato Grosso (FEPOIMT), Organização dos Professores Indígenas do Acre (OPIAC), and Red Mexicana de Organizaciones Campesinas Forestales (REDMOCAF) (see below).

21 Marengo, J.A., Nobre, C.A., Tomasella, J., Oyama, M.D., Sampaio de Oliveira, G., De Oliveira, R., Camargo, H., Alves, L.M. and Brown, I.F., 2008. The drought of Amazonia in 2005. *Journal of climate*, 21(3), pp.495-516.

22 McGrath, D. et al. 2020. Policy Brief: Can fish drive the bio-economy of the Amazon? https://earthinnovation.org/wp-content/uploads/2020/10/EII_Fish-Development-of-Amazon-Brief-9.pdf



IS THE FOREST- AND CARBON-POSITIVE SCENARIO PLAUSIBLE?

3. Carbon revenue could provide the finance that is missing from Brazil’s massive “PPCDAm” program

The third main reason we believe that the forest- and carbon-positive scenario is plausible is Brazil’s own “proof-of-concept”: it has already demonstrated that large-scale emissions reductions are possible over several years even in the absence of an adequate mechanism for financing those reductions (Figure 5).

From 2005 through 2012, Amazon deforestation declined 77% below the ten-year average (1996-2005) largely through an all-of-government strategy called the “Plan for the Prevention of Amazon Deforestation” (PPCDAm, Figure 2)²³. The Plan increased the area of Amazon forest under formal protection by two-thirds, increased law enforcement actions, and suspended farmer access to public credit in high-deforestation *municípios*. The plan was heavy on punitive measures and light on positive incentives, and became financially and politically difficult to sustain. Deforestation has nearly tripled over the last decade, although it is still below the historical average (Figure 4).

23 Nepstad, D. C., D. G. McGrath, C. Stickler, et al. 2014. Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. *Science*, 344(6188): 1118-1123.

This large contribution to climate change mitigation was met with a relatively small financial response from the international community. Only four percent of the more than seven billion tons of emissions reductions Brazil contributed to the global climate change challenge have been compensated through international climate results-based-payment donations²⁴. One reason that the level of compensation was not greater is that the carbon market for jurisdictional REDD+ was not ready. There was neither an operational J-REDD+ standard nor adequate market demand that could deliver the needed finance.

DEFORESTATION AND INTERVENTIONS TO SLOW IT DOWN

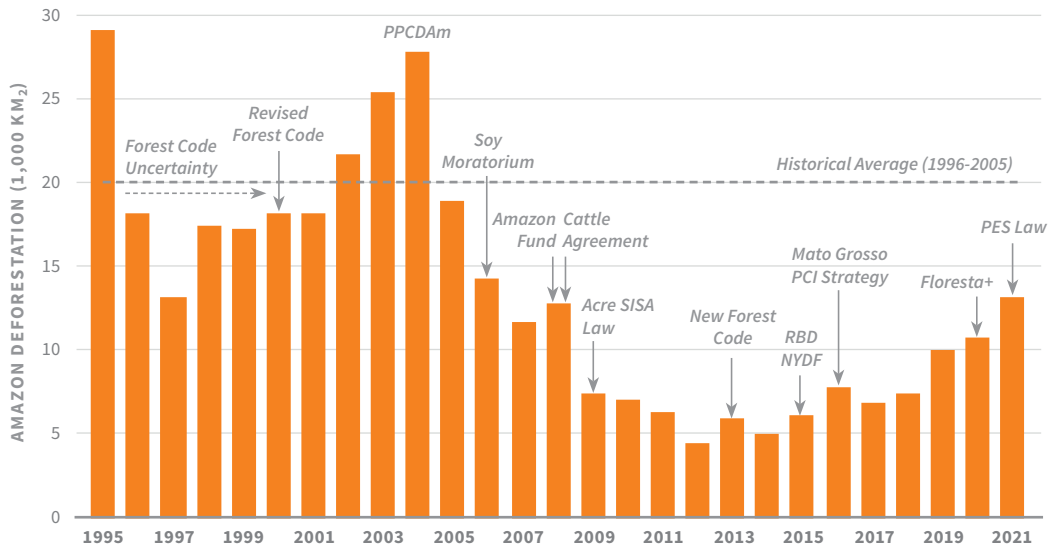


FIGURE 5. Annual deforestation in the Brazilian Amazon and the timeline of significant public policies and market interventions designed to slow deforestation. The all-of-government “Plan for the for the Prevention and Control of Amazon Deforestation” (PPCDAm) was the major cause for the decline, but was heavy on punitive measures and light on positive incentives²⁴ and therefore difficult to sustain. NYDF refers to the New York Declaration on Forests. RBD refers to the Rio Branco Declaration. SISA refers to the System for Environment Service Incentives. PCI stands for Produce, Conserve. Floresta+ is the federal government’s system for rewarding forest conserving communities and smallholders in Brazil. Data: INPE/PRODES 2022.

²⁴ Brazil has reduced emissions by 7.X GtCO₂ through the slowdown in Amazon deforestation from 2005 through the present, an estimate that has been reviewed by the UNFCCC and measured against a UNFCCC forest reference level. Four percent of the emissions reductions have been compensated through results-based-payments to the Amazon Fund, to the federal government from the Green Climate Fund, and through contracts between the state governments of Acre and Mato Grosso and the governments of Germany and the UK.

THE NUMBERS:

under the scenario, carbon credit revenues could be \$13 to \$48 billion US dollars by 2030

The forest- and carbon-positive scenario for the Amazon that we analyzed (Figure 2) would deliver approximately 2.5-2.6 GtCO₂ (billion tons CO₂) of emissions reductions by 2030 according to the three J-REDD+ standards. When discounted 40% to account for the risks of leakage, performance reversals (permanence) and measurement uncertainty²⁵, this volume of credits falls to 1.5 to 1.6 GtCO₂. If Brazil's J-REDD+ credits command a market price of \$10 to \$30 per tonne of CO₂, then the carbon-positive scenario for the Amazon would translate into \$13 to \$48 billion dollars of credit revenue by 2030 (Table 2).

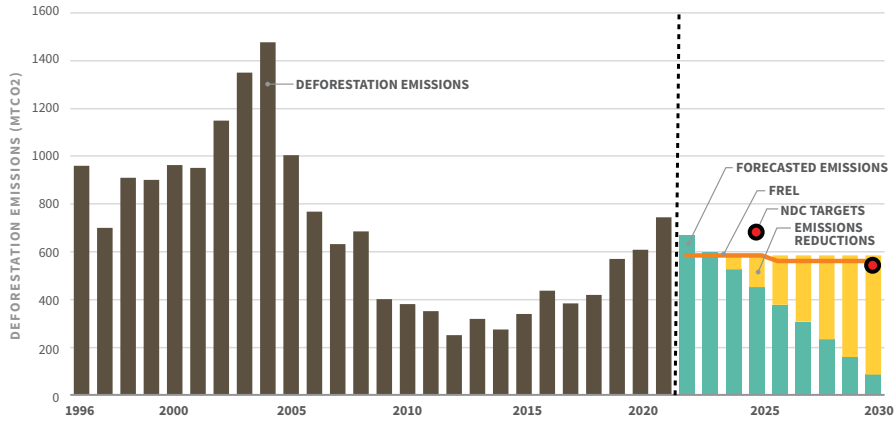
STATE	\$10 per tCO ₂ e				\$30 per tCO ₂ e			
	BR FREL	JNR	TREES	CA-TFS	BR FREL	JNR	TREES	CA-TFS
ACRE	0.44	0.87	0.77	0.33	1.33	2.62	2.30	0.98
AMAPA	0.06	0.07	0.07	0.04	0.18	0.20	0.21	0.12
AMAZONAS	0.91	2.18	1.92	1.19	2.74	6.53	5.75	3.57
MARANHÃO	1.88	0.44	0.52	0.63	5.63	1.32	1.56	1.88
MATO GROSSO	10.86	3.69	3.98	3.57	32.59	11.08	11.93	10.71
PARÁ	9.92	6.03	6.39	5.47	29.76	18.09	19.18	16.41
RONDÔNIA	2.92	1.55	1.52	0.94	8.75	4.65	4.57	2.83
RORAIMA	0.71	0.65	0.58	0.93	2.13	1.95	1.74	2.80
TOCANTINS	0.47	0.24	0.20	0.19	1.40	0.71	0.59	0.57
TOTAL	28.17	15.72	15.94	13.29	84.51	47.16	47.82	39.88

TABLE 2. Potential revenues from the sale of jurisdictional REDD+ credits by the states of the Brazilian Amazon using three international standards and a hypothetical Brazilian forest reference level. To estimate revenues, we assumed that emissions reductions would be discounted 40% to account for leakage, permanence and uncertainty. The price was assumed to range from \$10/tCO₂, a low estimate of future prices, to \$30/tCO₂, a likely price level for high quality credits and credits with corresponding adjustments.

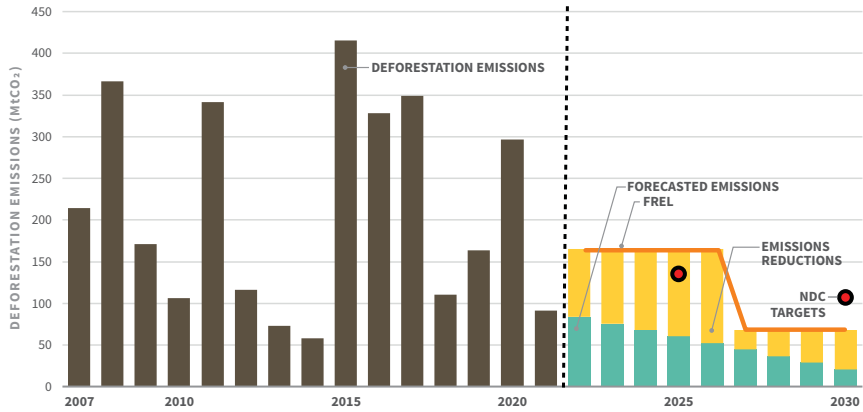
The states vary greatly in the volume of credits they would have to offer (Table 2). For example, the two states with the highest recent deforestation and forest degradation rates—Pará and Mato Grosso (Figure 5)—would be the source of two thirds of the monetized emissions reductions by 2030.

²⁵ These discounts are required by the standards and are designed to prevent credits from being issued for emissions reductions that didn't really happen or that happened and were then reversed. A discount level of 40% is at the high end of the likely range of discounts that the Brazilian Amazon state J-REDD+ programs would receive.

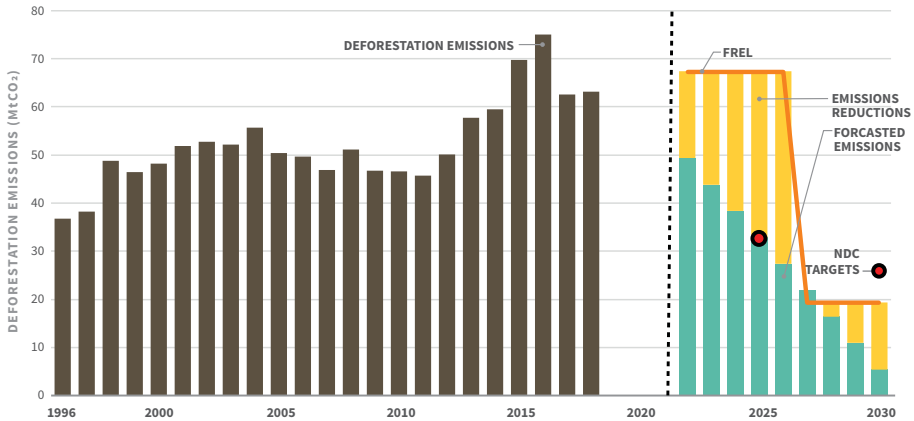
Primary Deforestation, Amazon Biome
 JNR FREL
 Total ERs 2022-2030 = 1.83 GtCO₂



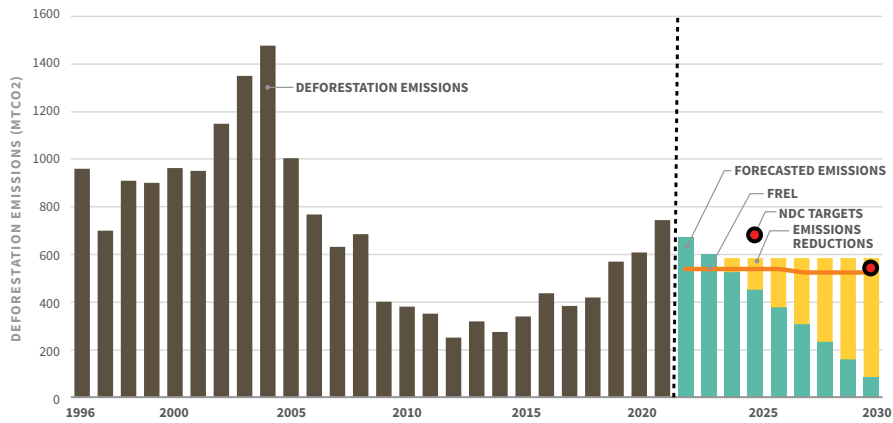
Primary Forest Degradation, Amazon Biome
 JNR FREL
 Total ERs 2022-2030 = 627.5 MtCO₂



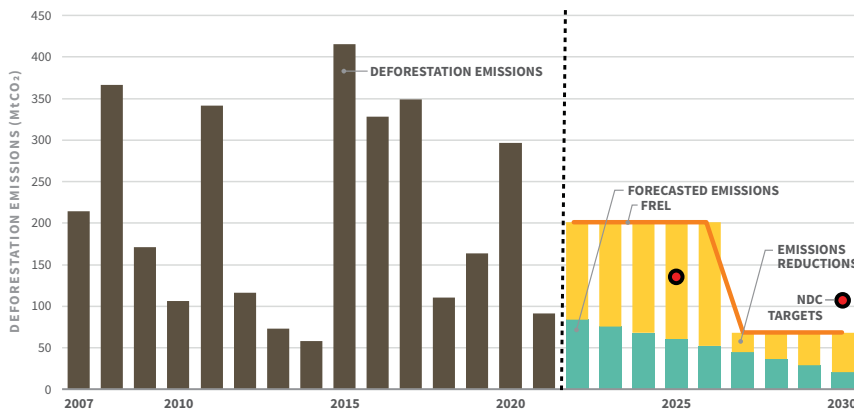
Secondary Deforestation, Amazon Biome
 JNR FREL
 Total ERs 2022-2030 = 170.6 MtCO₂



Primary Deforestation, Amazon Biome
ART/TREES FREL
Total ERs 2022-2030 = 1.59 GtCO₂



Primary Forest Degradation, Amazon Biome
ART/TREES FREL
Total ERs 2022-2030 = 810.4 MtCO₂



Secondary Deforestation, Amazon Biome
ART/TREES FREL
Total ERs 2022-2030 = 236.5 MtCO₂

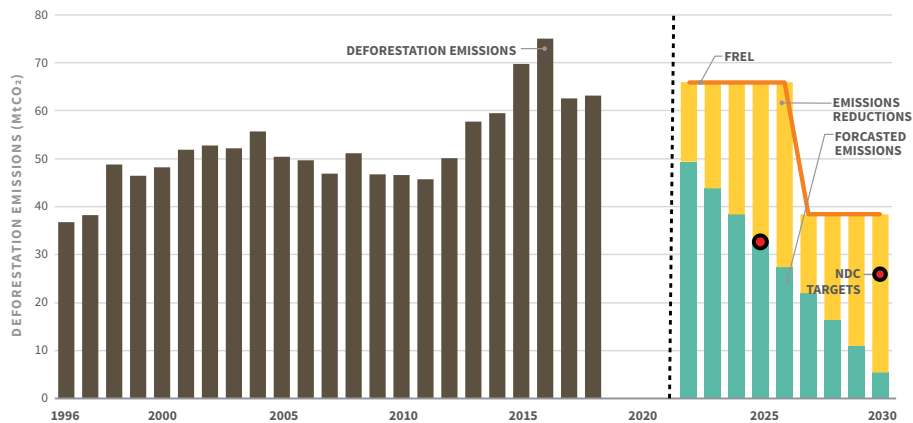


FIGURE 6. Historical primary deforestation, forest degradation, and secondary deforestation emissions in the Brazilian Amazon with projected decreases and potential emissions reductions achieved with JNR (5a-c) and ART/TREES (5d-f) reference levels, if deforestation and degradation are reduced to 90% below the historical average by 2030.

The forest carbon fluxes analyzed would yield varying levels of emissions reductions according to the rules of the standards analyzed. Emissions reductions from primary deforestation (1.6-1.7 GtCO₂) represent roughly two-thirds of the total, followed by degradation (0.6-0.8 GtCO₂) and secondary deforestation (0.2 GtCO₂) (Figure 6, Table 2). It is important to note the high year-to-year variability of emissions from degradation and the uncertainties surrounding this data.

We assume in this analysis that most of the removal of atmospheric carbon dioxide by the secondary forests of the Brazilian Amazon (Figure 7) would not be remunerated through carbon credit revenues. Secondary forests are a major component of Brazil’s nation-wide greenhouse gas emissions. The 16 M ha of secondary forests in the Brazilian Amazon are absorbing roughly 0.16 GtCO₂ per year, equivalent to 8% of national emissions (Figure 3). Most of these removals do not qualify as credits because they are not additional—they are occurring today without REDD+ interventions. The only removals that we have included as potential credits are those associated with the *added area* of secondary forests that would result from the decline in secondary deforestation (Figure 6c, f). The potential value of removals would be 222 to 228 million USD at a carbon price of \$10/tCO₂e.

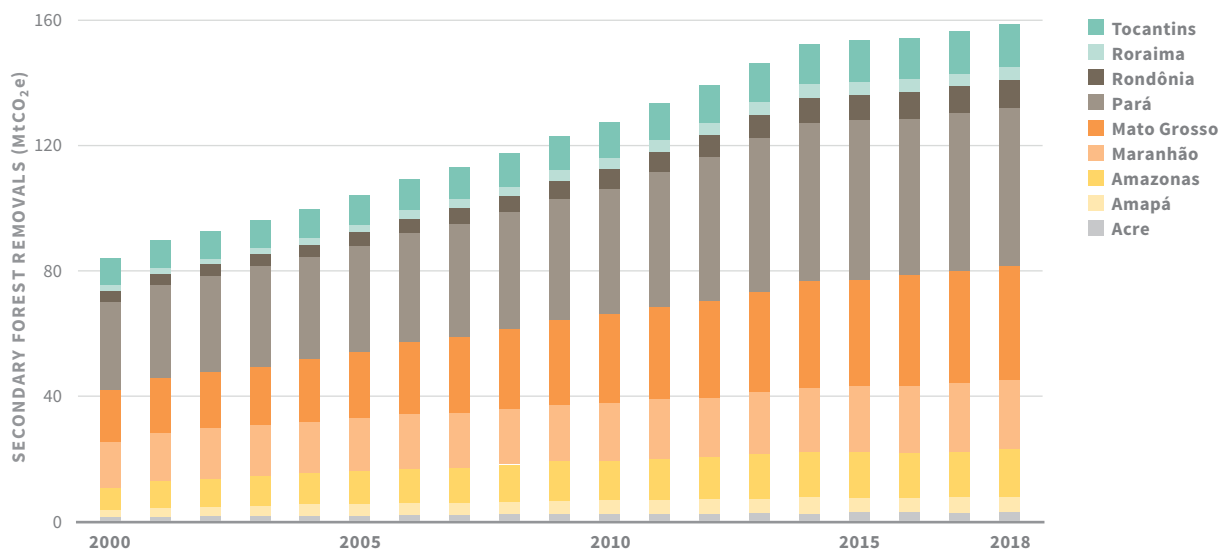


FIGURE 7. Removals of atmospheric carbon dioxide by secondary forest growth in the Brazilian Amazon by state. The area of secondary forests in the Amazon region of Brazil has been increasing for more than twenty years as deforested lands with low potential for agricultural or livestock production are neglected or abandoned by land holders. Source: MapBiomass.

Secondary forests are a critical element of Brazil’s decarbonization pathway. They increase the nation’s ability to meet and exceed its NDC targets, increasing the likelihood that Brazil can offer a large volume of high-value credits with corresponding adjustments. These forests tend to regenerate on land that is only of marginal productive potential for crops or livestock production, which means that the opportunity cost from forgone production associated with their expansion is low. They are a far cheaper way of getting forest back on the land than restoration. Protection from fire is sufficient for secondary forests to grow on land that has not been heavily used (e.g. mechanized), whereas forest restoration requires seedling production, planting and maintenance.

BRAZIL'S AMAZON STATES COULD SOON BE READY TO DELIVER HIGH-QUALITY FOREST CARBON CREDITS THAT MEET RIGOROUS INTERNATIONAL SOCIAL AND ENVIRONMENTAL SAFEGUARDS

The states of the Brazilian Amazon could become the first jurisdictions in the world to sell J-REDD+ credits. They have been preparing for the carbon market for a long time. The states of Acre, Amapá, Amazonas, Mato Grosso and Pará were founding members of the Governors' Climate and Forests Task Force (GCF TF), established in 2008 in California to help prepare tropical forest states and provinces around the world to participate in California's new carbon market. All nine states of the Brazilian Amazon are now GCF TF members. Most have established legal frameworks and governance structures for meeting the rigorous requirements of international standards for jurisdictional REDD+.

The members of the GCF TF have made important advances in recognizing (a) the rights of indigenous peoples and local communities, (b) the importance of the participation of these forest stakeholders in public policy processes, and (c) their right to a fair share of the financial benefits of carbon transactions. The fruits of that progress are spelled out in the landmark 2018 "Guiding Principles for Collaboration and Partnerships Between Subnational Governments, Indigenous People and Local Communities". These Principles are included in the California Tropical Forest Standard and are being implemented in Brazil through a regional committee for partnerships with indigenous peoples and local communities.

Brazilian Amazon states were also signatories to the Rio Branco Declaration of 2014, pledging to reduce deforestation 80% by 2020 if adequate finance and private sector partnerships were made available. Neither materialized at anywhere near the scale needed, however.²⁶ Only two states of the Brazilian Amazon — Acre and Mato Grosso—have received climate finance directly, through their results-based-payment contracts with the governments of Germany and UK.²⁷ Nine states have received a total of over \$260 million through grants from the Amazon Fund. Funding from the Amazon Fund, which is now idle, has been difficult for states to spend, however.



In the Fall of 2017, indigenous leaders, government delegates of the Governors Climate and Forests Task Force, and supporting institutions Earth Innovation and Environmental Defense Fund convened in the Yurok territory of northern California to build the Guiding Principles for Collaboration. Credit: Matt Colaciello.

²⁶ Stickler C, David O, Chan C, Ardila JP, Bezerra TB. 2020. The Rio Branco Declaration: Assessing progress towards a near-term voluntary deforestation reduction target in subnational jurisdictions across the tropics. *Frontiers in Forests & Global Change*. doi: 10.3389/ffgc.2020.00050

²⁷ Acre reduced emissions by a total of 147,8 MtCO₂ until 2017, just 20.9 MtCO₂ (14% of the total) were remunerated by Germany and United Kingdom through the REM Program with a total amount of USD 50.98 million. Mato Grosso reduced emissions by a total amount of 1156.3 MtCO₂ until 2017, just 14.9 MtCO₂ (1,3% of the total performed) were remunerated by Germany and the United Kingdom with a total amount of USD 36.98 million. (Source: Info Hub Brasil)



THIS CARBON REVENUE COULD REFINE, EXPAND AND REPLICATE CURRENT STATE-WIDE PROGRAMS THAT SUPPORT INDIGENOUS PEOPLES, FARMERS, AND SUSTAINABLE FOREST MANAGEMENT; THEY COULD INCUBATE NEW BIO-ECONOMY START-UPS

All states of the Brazilian Amazon have developed low-emissions development strategies for achieving systemic reductions in deforestation and forest degradation while alleviating poverty and bringing marginalized segments of rural society into the formal economy.²⁸ Each of these strategies is anchored in the guiding principles of collaboration and partnership with indigenous peoples described above. And each of these strategies needs significant finance to be implemented.

Acre and Mato Grosso are the only states of the Amazon region that hold jurisdictional REDD+ “results-based-payment” (Figure 1) contracts to finance their J-REDD+ strategies. These contracts are with the governments of Germany and the United Kingdom and exemplify how climate finance can be delivered to the stakeholders who are protecting forests on the ground. Both programs operate within Brazil’s National REDD+ Strategy (ENREDD+) and state legal frameworks

28 Acre (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_ACRE_DeLosRios_2018_ENG.pdf); Amapá (https://earthinnovation.org/wp-content/uploads/2014/09/Profile_AMAPA_Crisostomo_2020_ENG.pdf); Amazonas (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_AMAZONAS_Crisostomo_2018_ENG.pdf); Maranhão (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_MARANH%C3%83O_delosRios_2020_ENG.pdf); Mato Grosso (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_MATOGROSSO_Nepstad_2018_ENG.pdf); Pará (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_PAR%C3%81_Brand%C3%A3o_2018_ENG.pdf); Rondônia (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile Rondônia_Bezerra_2018_ENG.pdf); Tocantins (https://earthinnovation.org/wp-content/uploads/2018/09/profiles_led/SJS_Profiles_ENG/Brazil/Profile_TOCANTINS_DeLosRios_2020_ENG.pdf); Stickler, CM, AE Duchelle, JP Ardila, DC Nepstad, OR David, C Chan, JG Rojas, R Vargas, TP Bezerra, L Pritchard, J Simmonds, JC Durbin, G Simonet, S Peteru, M Komalasari, ML DiGiano, MW Warren. 2018. The State of Jurisdictional Sustainability. San Francisco, USA: Earth Innovation Institute/Bogor, Indonesia: Center for International Forestry Research/Boulder, USA: Governors’ Climate & Forests Task Force Secretariat. <https://earthinnovation.org/state-of-jurisdictional-sustainability/>; Stickler C, Duchelle AE, Nepstad D and Ardila JP. 2018. Subnational jurisdictional approaches: Policy innovation and partnerships for change. In Angelsen A, Martius C, De Sy V, Duchelle AE, Larson AM and Pham TT, eds. Transforming REDD+: Lessons and new directions. p. 145–159. Bogor, Indonesia: CIFOR. https://www.cifor.org/publications/pdf_files/Books/BAngelsen180112.pdf

BOX 1. In Mato Grosso, the prospect of J-REDD+ carbon finance led to a state-wide consultation with indigenous peoples and a program that has initially provided communities of all of the states' indigenous territories with COVID-19 support (<https://www.remmt.com.br/index.php/en-us/component/k2/itemlist/tag/fepoint>). The indigenous peoples' subprogram of Mato Grosso's jurisdictional REDD+ contract with the governments of Germany and UK was designed with the participation of 1300 indigenous people from all 43 contacted indigenous tribes, led by the Federation of Indigenous People of Mato Grosso (FEPOIMT), which represents the tribes. The indigenous peoples' subprogram has as its main thematic foci: territorial defense, development of funding of lifeplans, and participation in public policy processes.

created specifically for J-REDD+.²⁹ Both have created multi-stakeholder governance platforms and transparent benefit-sharing processes for allocating revenues. In both states there are state-wide programs for indigenous peoples³⁰, small-holders, forest timber management and improved law enforcement.

These “results-based-payment” contracts are best seen as important experiments in jurisdictional governance. They do not offer sufficient funding to make the transition to forest- and

carbon-positive development, especially in the face of the current high levels of profitability of beef and soy production and a national government that has reduced law enforcement budgets and is seeking to open indigenous territories to mining. In both states, deforestation rates have risen recently. Acre is larger than Portugal and Netherlands together, for example, and has a 3-year contract totalling \$25m. Mato Grosso, larger than France and Germany, twice the size of California, has a 3-year contract for \$50m, 0.05% of its \$29 billion GDP. This is simply not enough money to control vast agricultural frontiers, reward those who are conserving forests, and finance new economies, such as aquaculture that requires twenty times less land per ton of animal protein than the region's cattle operations. The scale of finance that could be delivered through J-REDD+ credit sales (Table 2) is more than ten times the amount of the Acre contract (\$0.8b over eight years) and twenty-five times the amount (\$3.7b over eight years) in Mato Grosso.

The J-REDD+ programs of the Brazilian Amazon continue to innovate. The states are developing new ways of receiving, managing and disbursing REDD+ revenues transparently and efficiently, outside of government coffers. Some are designing funds to finance bio-economy start-ups and low-carbon enterprises. Most are striving to validate the 745,000 CAR applications that have been submitted by Amazon landholders. The Brazilian Amazon states are also developing, or recently finalized, their Plans for the Prevention and Control of Deforestation and Forest Fires.

29 Stickler, CM, AE Duchelle, JP Ardila, DC Nepstad, OR David, C Chan, JG Rojas, R Vargas, TP Bezerra, L Pritchard, J Simmonds, JC Durbin, G Simonet, S Peteru, M Komalasarri, ML DiGiano, MW Warren. 2018. The State of Jurisdictional Sustainability. San Francisco, USA: Earth Innovation Institute/Bogor, Indonesia: Center for International Forestry Research/Boulder, USA: Governors' Climate & Forests Task Force Secretariat. <https://earthinnovation.org/state-of-jurisdictional-sustainability/>; Stickler C, David O, Chan C, Ardila JP, Bezerra TB. 2020. The Rio Branco Declaration: Assessing progress towards a near-term voluntary deforestation reduction target in subnational jurisdictions across the tropics. *Frontiers in Forests & Global Change*. doi: 10.3389/ffgc.2020.00050

30 DiGiano, M., Mendoza, E., Ochoa, M., Ardila, J., Oliveira de Lima, F. and Nepstad, D., 2018. The Twenty-Year-Old Partnership Between Indigenous Peoples and the Government of Acre, Brazil. *San Francisco, USA: Earth Innovation Institute (EII)*.

FOR THE STATES TO OFFER VERIFIED J-REDD+ CREDITS, THEY NEED UPFRONT FINANCE

The states need upfront finance to complete and implement their J-REDD+ programs and achieve the emissions reductions that are the basis of the potential forest carbon reviews analyzed here. This is an important limitation of the ex post financial mechanism of J-REDD+: it takes considerable funding to slow deforestation and forest degradation along vast agricultural frontiers and there is currently a dearth of upfront finance to cover these costs.

State governments of the Brazilian Amazon have tremendous potential to reduce emissions. Their collective environmental law enforcement programs are far larger than that of the federal government, for example, and they are empowered through Brazil's decentralization framework, the pacto federativo, to exercise this law enforcement function. They can establish and align laws and public policies to favor decarbonization pathways. They can negotiate trade agreements that favor sustainably-produced commodities.

The prospect of future payments for verified emissions reductions is an important but insufficient incentive for states to invest in the full implementation of their J-REDD+ programs. Many governments in the Brazilian Amazon have a “believe it when we see it” attitude towards the carbon market, since they have been waiting for it to materialize for more than a decade. They are reluctant to allocate significant public resources today for a benefit that is highly uncertain.

There are two main mechanisms for providing the upfront finance for implementing J-REDD+ programs. First, they can receive donations for emissions reductions already achieved--the “results-based payment” mechanism that is fully operational (Figure 1). A company with a net zero commitment, for example, could make a donation to a state that is recognized via a certificate issued by the federal government, although a credit transfer does not take place. The donation retires historical emissions reductions so that they are no longer available to attract further donations. This is what Germany and the UK have done in their results-based-payment contracts with Acre and Mato Grosso: they donated funds as compensation for historical emissions reductions. Brazil's historical emissions reductions are measured and reported to the UN Framework Convention on Climate Change in its biannual emissions reports. The UNFCCC submits these reports to its roster of experts for review.

A second mechanism for providing upfront finance is through advance purchase agreements for J-REDD+ credits that have not yet been created or verified. Such advance purchase agreements are currently under discussion between state governments and at least one major buyer. In this case, the buyer must be prepared to accept the risk that the state program does not deliver verified J-REDD+ credits.



SUGGESTED ACTIONS BY THE FEDERAL GOVERNMENT

To realize this new carbon market opportunity, initially a clear signal is needed from the federal government to the Amazon state governments that they should pursue commercial agreements to sell verified credits from their jurisdictional REDD+ programs in the voluntary market. These credits would not carry corresponding adjustments, meaning they can be claimed by Brazil and no other country towards its Paris (NDC) targets. In the absence of this signal, uncertainty will inhibit transactions and financial flows.

A comprehensive decarbonization strategy would include a national system for measuring and allocating emissions reductions among national and state governments. This means completing the national forest reference level that is currently under development to provide the baseline for Brazil to measure emissions reductions from avoided deforestation, avoided forest degradation, and increased removals from secondary forest regeneration from 2021 onward, consistent with the REDD+ rules established under the UN Framework Convention on Climate Change (UNFCCC). A decision will be needed on how to harmonize Brazil's new national FREL with the state-level FREL's established according to the rules of international standards, such as JNR, ART/TREES and the California Tropical Forest Standard. This harmonization is needed to avoid double counting, which would happen, for example, if the same emissions reductions are being sold as J-REDD+ credits by the states and as ITMO's by the federal government.

A decision on the allocation of Amazon emissions reductions between federal and state governments and among states is another important step. Ideally, this decision will be informed by an analysis of the optimal allocation of emissions reductions for accelerating progress down the decarbonization pathway. This allocation process is fully operational today³¹ for forest carbon transactions that occur through results-based-payment contracts. It is overseen by the National REDD+ Council (CONAREDD).

Brazil must improve its system for inventorying and registering greenhouse gas emissions. The current system, called "SIRENE" (Sistema de Registro Nacional de Emissões), is designed for reporting to the UNFCCC. The frequency (every 5 years) and high level of aggregation of its inventory and GHG emission reporting process is not adequate for the new Article 6 framework for international emissions reduction

³¹ Today, the National REDD+ Council (CONAREDD) determines the allocations of emissions reductions to state (60%) and federal (40%) governments and among states (using a stock-flow formula that weights forest carbon stocks and emissions reductions equally) for use in results-based-payment contracts.

transactions. A new system will require reporting that is conducted annually and provided at the level of the major emitting sectors and entities.

Brazil will also need a national emissions reductions registry designed to link with international rules and protocols established by the UNFCCC, new markets such as CORSIA (the Carbon Offsetting and Reduction Scheme of International Aviation), the current voluntary market, and the forthcoming ITMO and A6.4ER markets (Figure 3). This registry should facilitate and provide a backbone for domestic offset trading with legal and climate integrity .

The legislative bill number 528/2021 and its substitute, number 2148/2022, provide both the basis for this registry and for the creation of a Brazilian emissions trading system, a compliance market similar to the one in Europe, California and other jurisdictions where forest offsets can be traded.