Forest Degradation

A cryptic source of carbon emissions in the Brazilian Amazon

POLICY BRIEF

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IPAM Amazônia

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KEY POINTS

- Forest degradation and disturbance are significant and growing sources of CO_2 emissions from the Brazilian Amazon, and must be included in annual emissions monitoring.
- Controlling illegal land grabbing in undesignated public lands—a major driver of deforestation and degradation—is essential for reducing forest carbon emissions.
- Protected forests of all types are effective in preventing deforestation and protecting carbon stocks, but may require stronger management to prevent or mitigate emissions from forest degradation.

NASA Earth Observatory (MODIS Terra natural-color image, August 9, 2019 near Novo Progresso, Pará, Brazil).

BACKGROUND

Stopping emissions from deforestation will be critical for tropical nations to achieve their emissions targets, and for the world to address the climate crisis. Maintaining forest integrity also brings a range of co-benefits. By stabilizing regional climate, forests help mitigate the negative impacts of climate change on agricultural production; support the livelihoods of indigenous peoples and traditional communities; conserve biodiversity; and improve water and food security.

Although Brazil succeeded in slowing Amazon deforestation from 2005-2012[1], emissions from forest clearing have climbed steadily since then (Figure 1), culminating in 365 $MtCO_2$ in 2019. The recent spike in deforestation—and the fires that followed—have worsened the prospects of Brazil reaching its emissions targets, but that is only part of the story. Forest degradation and disturbance have also become significant sources of CO_2 emissions, accounting for 38% of forest carbon emissions (3,114 $MtCO_2$) in the Brazilian Amazon from 2003-2016[2].

Despite their growing importance, few tropical nations explicitly account for forest degradation and disturbance in their annual emissions estimates, and even fewer have the capacity to attribute them to specific actors. Here we combine annual spatial data on deforestation[3] and biomass change[4] with recent land tenure data[5,6] to provide a comprehensive emissions estimate and analyze the relative importance of deforestation and forest degradation/disturbance across land tenure categories.

Tracking forest emissions. The level of protection and land tenure strongly influence emissions from deforestation and forest degradation (Figure 2). From 2003-2016, emissions from the Brazilian Amazon totaled 8,238 $MtCO_2$, with 62% of those emissions attributed to deforestation and the remainder to forest degradation or disturbance. The majority of emissions came from deforestation in private properties or mixed urban/suburban landscapes (e.g. Other Lands), some of which could be legal. Undesignated lands contributed the highest total emissions (1,369 $MtCO_2$) per unit area, nearly all of which (88%) came from illegal deforestation. In contrast, emissions from Indigenous Territories and Protected Areas were relatively low (1,744 $MtCO_2$), and most of those (77%) came from forest degradation—the result of natural disturbances, wildfires, illegal logging, or subsistence activities, among others.

Rising CO_2 emissions from deforestation of the Brazilian Amazon

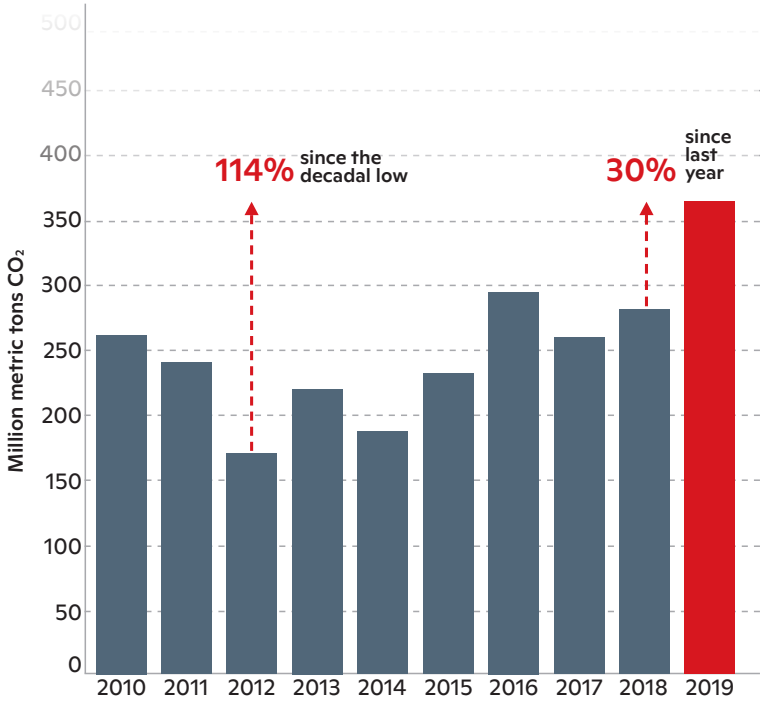

FIGURE 1: Annual CO_2 emissions attributed to deforestation from 2010 to 2019. Analysis and data by Woodwell, INPE.

1. Moutinho P, Guerra R, & Azevedo-Ramos C (2016) Achieving zero deforestation in the Brazilian Amazon: What is missing? *Elem Sci Anth* 4.
2. Walker WS, et al. (2020) The Role of Forest Conversion, Degradation, and Disturbance in the Carbon Dynamics of Amazon Indigenous Territories and Protected Areas. *Proceedings of the National Academy of Sciences* 117 (6) 3015-3025.
3. Hansen MC, et al. (2013) High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science* 342:850-853.
4. Baccini A, et al. (2017) Tropical forests are a net carbon source based on aboveground measurements of gain and loss. *Science* 358(6360):230-234.
5. Azevedo-Ramos C & Moutinho P (2018) No man's land in the Brazilian Amazon: Could undesignated public forests slow Amazon deforestation? *Land Use Policy* 73:125-127.
6. RAISG (2017) *Pan Amazon, Indigenous Land and Protected Area boundaries*. Available at https://raisg.socioambiental.org (Red Amazonica de Informacion Socioambiental Georeferenciada).

IMPLICATIONS

Land grabbing. An estimated 64 million hectares (Mha) of public forests remain undesignated today, an area nearly twice the size of Germany. Because they are vulnerable to illegal land grabbing, these areas contribute disproportionately to forest emissions, accounting for ~30% of recent Amazon deforestation in 2019 and ~17% of total forest emissions from 2003-2016.

Losses in aboveground carbon (MtC) from 2003-2016 in the Brazil Amazon

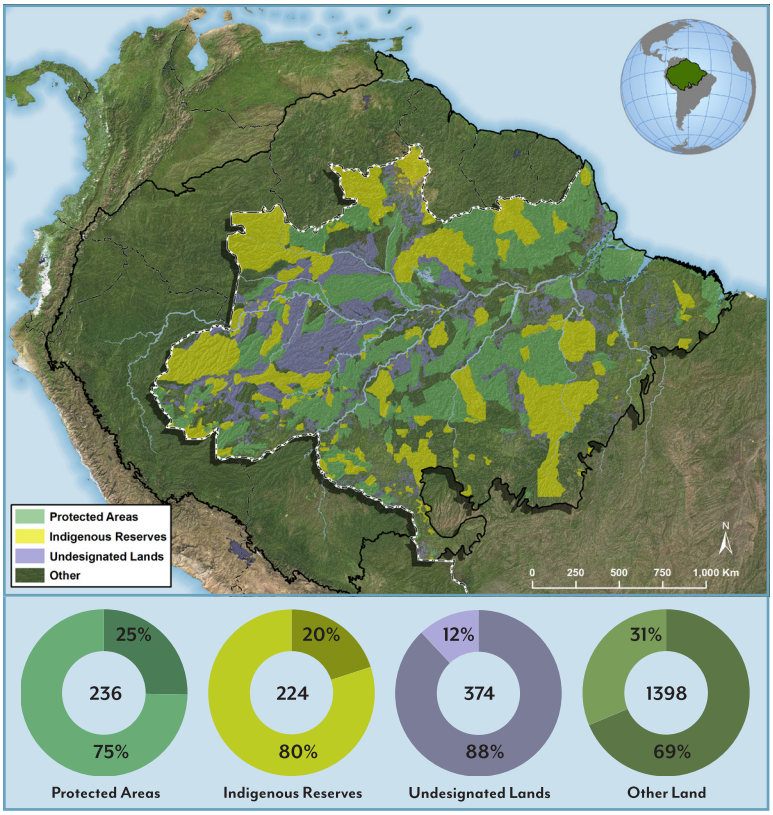

FIGURE 2: Attribution of carbon losses to deforestation (dark shades) and forest degradation (light shades) across land categories (colors).

Indigenous reserves. Indigenous peoples play a crucial role in protecting forest carbon. Although indigenous lands cover 23% of the Amazon, they contribute fewer emissions (10%) than all other land categories. Maintaining their vital role in carbon storage will require new management strategies, as climate change has already increased the risk of droughts, wildfires, and other forest disturbances. Ignoring these new threats could allow forest degradation and associated carbon emissions to increase substantially.

National targets. Brazil's national emissions estimates assume that Amazon forests are a substantial carbon sink, but recent data suggests otherwise. Whether carbon uptake (e.g. forest growth) can offset losses will depend on the frequency of disturbance and overall health of remaining forests. Even protected forests are vulnerable to degradation and disturbance, emissions that are often unaccounted for[4]. Understanding the drivers and patterns of forest carbon emissions is essential for designing effective climate mitigation strategies—and will be key for Brazil to achieve its commitments under the Paris Agreement.

Indigenous village / photo by Paulo Brando

4. Baccini A, et al. (2017) Tropical forests are a net carbon source based on aboveground measurements of gain and loss. *Science* 358(6360):230-234.

RECOMMENDATIONS

Designate undesignated lands. Formally protecting or clarifying land tenure in undesignated lands is critical to combat illegal land grabbing, deforestation, and degradation in the Brazilian Amazon.

Monitor forest degradation. Given that degradation often precedes deforestation, real-time monitoring and reporting on forest degradation is essential to prevent future deforestation, reduce emissions, and achieve Brazil's national commitments under the Paris Agreement.

Promote land-use efficiency. Reducing pressure on forests will require incentives to encourage land-use efficiency; technical assistance to improve productivity on already cleared lands; and effective monitoring, enforcement, and management of protected forests[7,8].

Protect protected forests. Brazil has a strong network of protected areas and indigenous lands; a legal framework that supports forest protection on public and private lands; and the technical capacity to monitor and enforce both. Continued investments in these programs is a cost-effective way to meet its national targets and be part of the solution to the climate crisis.

7. Stabile MCC, et al. (2019) Solving Brazil's land use puzzle: Increasing production and slowing Amazon deforestation. *Land Use Policy*.
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photo by Paulo Brando

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