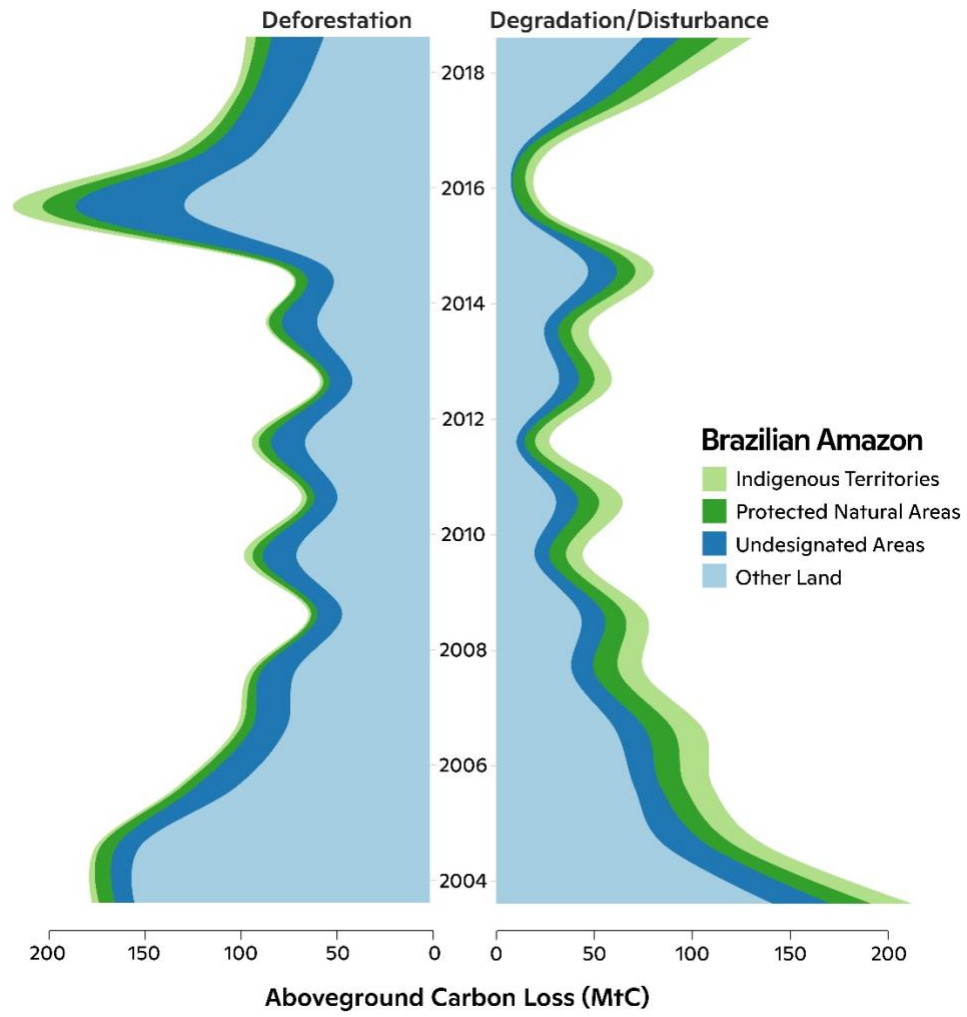


## Supplemental Information



**Figure S1:** Annual gross carbon losses due to deforestation (forest conversion) and degradation/disturbance for each land tenure category in the Brazilian Amazon from 2003 to 2019.

**Table S1:** Summary of carbon dynamics for each land tenure category in the Brazilian Amazon from 2003 to 2019.

	Area		Stock 2003		Stock 2019		Net Change		Gains		Losses						
											FC		D/D		Total		
Brazilian Amazon	km <sup>2</sup>	%	MtC	%	MtC	%	MtC	%	MtC	%	MtC	%	MtC	%	tC/km <sup>2</sup>		
Protected Land																	
Indigeneous Territories	1,061,530.5	25%	13,595.2	29%	13,692.7	30%	97.4	0.72%	345.4	18%	-60.8	4% 25%	-187.1	14% 75%	-248.0	8% 100%	-233.6
Protected Natural Areas	881,853.5	21%	12,039.9	25%	12,043.0	26%	3.1	0.03%	294.0	15%	-107.5	6% 37%	-183.4	14% 63%	-290.9	10% 100%	-329.9
Subtotal	1,943,384.0	46%	25,635.1	54%	25,735.7	56%	100.5	0.39%	639.4	33%	-168.3	10% 31%	-370.5	28% 69%	-538.9	18% 100%	-277.3
Unprotected Land																	
Undesignated Areas	624,659.5	15%	8,045.3	17%	7,779.7	17%	-265.6	-3.30%	244.7	13%	-310.8	18% 61%	-199.5	15% 39%	-510.3	17% 100%	-816.9
Other Land	1,644,253.3	39%	13,602.4	29%	12,679.9	27%	-922.5	-6.78%	1,070.0	55%	-1,228.8	72% 62%	-763.7	57% 38%	-1,992.5	66% 100%	-1,211.8
Subtotal	2,268,912.8	54%	21,647.7	46%	20,459.6	44%	-1,188.1	-5.49%	1,314.7	67%	-1,539.6	90% 62%	-963.2	72% 38%	-2,502.8	82% 100%	-1,103.1
Total	4,212,296.9	100%	47,282.8	100%	46,195.3	100%	-1,087.5	-2.30%	1,954.2	100%	-1,707.9	100% 56%	-1,333.8	100% 44%	-3,041.7	100% 100%	-722.1

Table S1 summarizes the carbon dynamics observed in each land tenure category from 2003 to 2019. *Column 1:* Protected lands include Indigenous Territories (ITs) and Protected Natural Areas (PNAs); Unprotected Lands include Undesignated Public Forests (UPFs) and Other Land (private properties, mixed use areas, and urban areas). *Column 2:* The total land area in km<sup>2</sup> for each land tenure category. *Columns 3-4:* Total carbon stocks occurring in each category at the beginning (2003) and end (2019) of the study period. The remaining columns show, in order, the net change in carbon stocks (MtC) from 2003-2019; gross gains in carbon stocks; and gross losses in carbon stocks due to forest conversion (FC; deforestation), and forest degradation and disturbance (D/D). Numbers highlighted in gray indicate the percentage of the total area, carbon stock, or carbon flux attributed to each category; numbers highlighted in blue indicate the percent change in stock since 2003 in a given category; and numbers highlighted in red indicate the percentage of total losses attributed to FC or D/D. The 2020 boundaries for ITs and PNAs (RAISG 2020) and UPFs (IPAM 2020) used in this analysis were clipped to the biogeographical limit of the Brazilian Forest Biome. In areas where ITs and PNAs overlap, we assigned all carbon to ITs. Carbon in Environmental Protected Areas (Áreas Protegidas Ambientais; APAs) was assigned to the Other Land category. Carbon in areas where UPFs and protected lands overlapped was assigned to UPFs.

**Table S2:** Survey of relevant local, regional, and international climate policies

Policy	Scale	Main targets	Target land use/tenure category	Connection to other policies
Governors' Climate and Forests Task Force <sup>i</sup>	Regional	<ul style="list-style-type: none"> <li>Reduce deforestation and promote sustainable, low-emissions economic development across state and provincial jurisdictions, while forging partnerships and sharing benefits with indigenous peoples and local communities.</li> </ul>	Indigenous lands	<ul style="list-style-type: none"> <li>Contributes to the achievement of Brazil's Nationally Determined Contributions (NDC) under the Paris Agreement</li> <li>Recognizes UNDRIP - United Nations Declaration on the Rights of Indigenous Peoples and Article 231 of the Federal Constitution to protect and respect indigenous people's territories.</li> </ul>
Brazil's NDC - Paris Agreement <sup>ii</sup>	National	<ul style="list-style-type: none"> <li>Reduce greenhouse gas emissions by 37% by 2025 below the 2005 reference level.</li> <li>Reduce emissions by 43% by 2030.</li> <li>Reduce illegal deforestation in the Amazon to zero by 2030.</li> </ul>	All land tenure regimes	<ul style="list-style-type: none"> <li>Provides the basis for ambition on climate action, to be implemented through national policies.</li> </ul>
Brazil's National Climate Change plan <sup>iii</sup>	National	<ul style="list-style-type: none"> <li>Voluntary commitment to the UNFCCC to reduce emissions by 38.9% of predicted emissions by 2020. Sets a target of 80% reduction in Amazon deforestation.</li> </ul>	All land tenure regimes	<ul style="list-style-type: none"> <li>Predecessor of NDC commitments.</li> </ul>
Brazilian Forest Code <sup>iv</sup>	National	<ul style="list-style-type: none"> <li>Legally binding rules with regard to the use and conservation of natural vegetation in privately-owned land in the Amazon (and Cerrado) biome: <ul style="list-style-type: none"> <li>Conservation of areas that are critical to maintain important ecosystem functions, such as soil stability, a steady and clean water supply and regulating local weather cycles (Permanent Preservation Areas; APP).</li> <li>Conservation of 35-80% of natural vegetation of privately-owned land in the Brazilian Amazon (Forest Legal Reserves; FLR), in addition to the conservation of APPs.</li> </ul> </li> </ul>	Other land: private properties	<ul style="list-style-type: none"> <li>Important piece of legislation that provides the basis of other climate and forest related policies.</li> </ul>
Article 231 of the Federal Constitution <sup>v</sup>	National	<ul style="list-style-type: none"> <li>Demarcate, protect and respect indigenous people's territories and their assets.</li> </ul>	Indigenous lands	<ul style="list-style-type: none"> <li>Protection of indigenous lands practically equals conserving the natural vegetation in these lands. In addition to the moral obligation to respect Indigenous Lands, it is also important for preservation of ecosystems.</li> </ul>
REDD+ <sup>vi</sup>	International	<ul style="list-style-type: none"> <li>Create incentives for environmental services, with a focus on state-wide carbon emissions reductions.</li> <li>Attract funds to reward for conservation and reductions in deforestation at the jurisdictional level.</li> </ul>	All land tenure regimes, but primarily public	<ul style="list-style-type: none"> <li>By providing incentives not to deforest both public and private stakeholders are stimulated to preserve natural vegetation.</li> </ul>

Policy	Scale	Main targets	Target land use/ tenure category	Connection to other policies
Brazil's national targets: Aichi Biodiversity Convention <sup>vii</sup>	International	<ul style="list-style-type: none"> <li>By 2020, the rate of loss of native habitats is reduced by at least 50% (in comparison with the 2009 rate) and, as much as possible, brought close to zero, and degradation and fragmentation is significantly reduced.</li> <li>By 2020, at least 30% of the Amazon is conserved through protected areas foreseen under the SNUC Law and other categories of officially protected areas such as PPA's, FLRs and indigenous lands with native vegetation.</li> <li>By 2020, the traditional knowledge, innovations and practices of indigenous peoples, family rural producers and traditional communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, in accordance with their uses, customs and traditions, national legislation and relevant international commitments.</li> </ul>	All land tenure regimes	<ul style="list-style-type: none"> <li>The Aichi targets directly relate to the conservation of natural vegetation as well as respecting Indigenous Lands.</li> </ul>
UNDRIP – UN Declaration on the Rights of Indigenous Peoples <sup>viii</sup>	International	<ul style="list-style-type: none"> <li>Give legal recognition and protection to indigenous lands, territories and resources.</li> </ul>	Indigenous lands	<ul style="list-style-type: none"> <li>This policy directly relates to Article 231 of the Brazilian Federal Constitution. Protection of indigenous people and their lands is important for the conservation of natural vegetation on these lands.</li> </ul>
UN Sustainable Development Goals (SDGs) <sup>ix</sup>	International	<ul style="list-style-type: none"> <li>SDG12 Responsible consumption and production <ul style="list-style-type: none"> <li>12.2 By 2030, achieve the sustainable management and efficient use of natural resources.</li> </ul> </li> <li>SDG13 Climate Action <ul style="list-style-type: none"> <li>13.2 Integrate climate change measures into national policies, strategies and planning.</li> </ul> </li> <li>SDG 15 Life on Land <ul style="list-style-type: none"> <li>15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.</li> <li>15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.</li> <li>15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.</li> </ul> </li> </ul>	Various land tenure regimes	<ul style="list-style-type: none"> <li>The SDGs are the overarching goals that relate to almost any development and sustainability related policy. The three mentioned SDGs relate most to the other named policies.</li> </ul>

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<sup>i</sup> GCFTF (Governors Climate and Forest Task Force) (2017). Guiding Principles for Collaboration and Partnership Between Subnational Governments, Indigenous Peoples and Local Communities. Available at: <https://www.gcftf.org/resource/guiding-principles/>, Accessed on 10-22-2020.

<sup>ii</sup> NDC Registry (2021). Brazil. Available at: <https://www4.unfccc.int/sites/NDCStaging/pages/Party.aspx?party=BRA>, Accessed on 04-23-2021.

<sup>iii</sup> Nepstad et al. (2014). Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. *Science* 344, 1118. Supplemental material.

<sup>iv</sup> Soares-Filho, B., Rajão, R., Macedo, M., Carneiro, A., Costa, W., Coe, M., Rodrigues, H., and Alencar, A. (2014). Cracking Brazil's Forest Code. *Science*, 344(6182), 363-364.

<sup>v</sup> Brazil's Federal Constitution (2008). Article 231. Available at: <https://www.wipo.int/edocs/lexdocs/laws/en/br/br117en.pdf>, Accessed on 04-23-2021.

<sup>vi</sup> Nepstad et al. (2014). Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. *Science* 344, 1118. Supplemental material.

<sup>vii</sup> CBD (Convention on Biological Diversity) (2020). National targets Brazil. Available at: <https://www.cbd.int/nbsap/targets/>, Accessed on 04-23-2021.

<sup>viii</sup> UNDESA. (2007). United Nations Declaration on the Rights of Indigenous Peoples. Available at: <https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html>, Accessed on 10-21-2020.

<sup>ix</sup> UNDESA (United Nations Department of Economic and Social Affairs) (2021). Available at: <https://sdgs.un.org/goals>, Accessed on 04-23-2021.