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## Stimulus for land grabbing and deforestation in the Brazilian Amazon

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**Title: Stimulus for land grabbing and deforestation in the Brazilian Amazon**

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**Abstract:** We assessed the impact on the Brazilian Amazon of a 2017 land law that reinforces a mechanism for acquiring land rights historically linked to deforestation, since land grabbers clear the forest to signal land occupation and claim land rights. In particular, we assessed two significant potential impacts: i) the loss of government revenue due to the sale of public land below market prices and ii) the risk of future deforestation and associated CO<sub>2</sub> emissions in 19.6 million hectares allocated to expand land privatization. The short term revenue loss ranges from US\$ 5 to 8 billion for 8.6 million hectares; the future revenue loss ranges from US\$ 16.7 to 23.8 billion for 19.6 million hectares; and between 1.1 to 1.6 million hectares would risk being deforested until 2027, which could emit 4.5 to 6.5 megatonnes of CO<sub>2</sub>. The Brazilian government should review the decision about this area allocation; prioritize land allocation for conservation and, if selling part of this area, charge market prices.

**Key words:** Brazilian Amazon – Deforestation – Land prices – Land tenure

**Introduction:**

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3 In 2017, the Brazilian government revised the country's rules on land tenure regularization and  
4 this new law threatens efforts to reduce forest loss in the Amazon. After a significant reduction  
5 of deforestation in the region between 2005-2012 (1), the annual forest loss rates in the region  
6 began to increase again, reaching the highest rate in the last decade in 2018 (7,900 km<sup>2</sup>) (2). In  
7 addition, the relationship between deforestation, land grabbing and violent land conflicts, that  
8 has been documented by previous studies (3, 4), continues in the region. In 2017, Brazil had the  
9 highest rate of murders of environmental and land rights defenders, and 80% of the victims were  
10 in the Amazon region (5).

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12 The current political context in the country may worsen this scenario of degradation and  
13 violence. As of January 2019, Jair Bolsonaro, the newly elected president of Brazil, has indicated  
14 his support for the agribusiness section in the region, for weakening environmental enforcement,  
15 and freezing the demarcation of indigenous territories (6). But all of these measures, if  
16 implemented, could also lead to more deforestation and conflict. Thus, the implementation of the  
17 new land law and the new national political scenario may represent a threat to the Amazon forest  
18 conservation. At the same time, this context may hinder Brazil's pledges to the Paris Accord to  
19 reduce greenhouse gases (GHG) emissions. The country is the seventh largest emitters of GHG  
20 and its commitments to global efforts to climate change mitigation rely mostly on curbing  
21 deforestation (1).

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23 Passed in July 2017, the new land law (number 13,465) granted amnesty to those who illegally  
24 occupied public rural lands between 2005 and 2011, a crime according to a 1966 federal law.

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26 The new rule allows land grabbers to purchase public lands below market prices. Also, the new  
27 law extends these benefits for large areas up to 2,500 hectares (1), which represents a 1,000  
28 hectares increase compared to the previous legislation (7). All these factors have the potential to  
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3 stimulate further land grabs and forest loss, since they reinforce a preemption mechanism for  
4 acquiring land rights (7) that has been historically linked to deforestation in the Amazon region  
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6 (8–10).  
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10 In this preemption mechanism: i) the private parties occupy public land and, in some cases, expel  
11 indigenous peoples or traditional communities previously occupying these areas; ii) they deforest  
12 the area and plant grass to raise cattle, which is a relatively cheap way to signal land use (10); iii)  
13 they request a land title from the government as a formal recognition of their land occupation.  
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19 When land grabbers occupy public areas after the legal deadline for granting land rights, they  
20 reach representatives in Congress, usually from the so-called rural caucus (*ruralistas*), to demand  
21 a legal revision for extending such deadlines and to demand land price discounts. For instance, in  
22 the previous law, landholders that occupied federal public areas as of July 2004 could request a  
23 land title from the federal government upon compliance with some requirements, including not  
24 owning another rural property (7). However, the government has extended the 2004 deadline to  
25 2011 in the 2017 legal revision. As of January 2018, three lawsuits were questioning the  
26 constitutionality of this law before the Brazilian Supreme Court.  
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37 In addition to promoting the privatization of public lands, the federal government has reduced  
38 the pace of demarcation of indigenous lands and creation of conservation units (1), both  
39 considered important mechanisms to recognize land rights of indigenous peoples and traditional  
40 communities, while acting as barriers to the advance of deforestation (11, 12). There are 70  
41 million hectares of non-allocated forest in the Brazilian Amazon and this area has potential for  
42 creation of new protected areas and allocation to social use (13, 14). However, the focus on land  
43 privatization may stimulate new illegal occupation of land associated with deforestation.  
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3 Given the new legal and political context, in this study we use a spatially explicit dataset of  
4 public land allocated for future land privatization in the Brazilian Amazon to assess two possible  
5 impacts of the new law : i) the loss of government revenue due to the sale of land below market  
6 prices and ii) the risk of future deforestation and associated carbon dioxide (CO<sub>2</sub>) emissions.  
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## 12 **Methods**

### 15 *Assessing revenue loss*

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17 First, we estimated the potential governmental revenue loss in two sets of public land stocks as  
18 follows:  
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- 21 i) Short-term revenue loss due to sale of 32,490 parcels, accounting for 8.6 million hectares in  
22 the Brazilian Amazon. These parcels are in the process of receiving a land title through sale  
23 from the Brazilian government and their sizes range from 50 to 2,500 hectares.  
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- 26 ii) Future revenue loss in public land designated for potential future sale encompassing 19.6  
27 million hectares. Even though there are 70 million hectares without formal recognition of  
28 land rights in the Amazon (13, 14), we used a smaller dataset of areas where the government  
29 plans to expand its program to issue land titles. These areas are under direct risk of land  
30 grabbing, since the government is signaling it will issue land titles in the future for the  
31 landholders. According to this dataset, obtained through the Access to Public Information  
32 Law, the 19.6 million hectares includes one million hectares that overlap with potential  
33 indigenous land claims.  
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47 We estimated the revenue loss by calculating the difference between the market price and  
48 governmental price for these areas. We considered the average land market price in 2016 per  
49 municipality (15) and four scenarios for governmental land prices established by the new law,  
50 summarized in Table 1. The two highest governmental prices apply when: i) the land title  
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beneficiaries want to avoid losing the parcel if they fail to comply with certain labor and environmental regulations after receiving the land title and ii) the landholder has another property or occupied the public land between 2008-2011. For payments in installments and lump sum, the Federal Decree 9,304/2018 establishes the percentage of land price to be charged in each case, depending on the parcel size. Since we did not have the parcel sizes in the area allocated for future regularization, we calculated the range of possible values determined by the land law, from 10% and 50% of the minimum governmental land price.

Table 1. Scenarios of land prices according to market and government rules used in the estimation of potential revenue loss.

	Payment in installments	Lump sum payment	Avoiding future land retaking	Area occupied between 2008-2011 or when landholder owns another property
Governmental price	10% to 50% of the minimum governmental land value	80% of governmental price payment in installments (a 20% discount)	100% of the mean governmental land price	100% of the maximum governmental land price
Market price	100% of the average market price per municipality	80% of market price payment in installments (a 20% discount)	100% of the mean market price per municipality	100% of the average market price per municipality

#### *Assessing risk of future deforestation and CO<sub>2</sub> emissions*

We assessed the risk of future deforestation in the 19.6 million hectares allocated to expand land privatization. Forty-four percent of this area was already deforested as of 2016. We applied the methods used by Barreto and colleagues (16) to estimate the risk of future deforestation in 2017-2027 as a consequence of the advance of the cattle ranching frontier if this area is allocated for

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3 private landholdings. We modified the methodology for this study by extending the period  
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5 analyzed, from three to ten years. Below is a description of the methodology steps:  
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- 8 1. We quantified the remaining forest in the 19.6 million hectares based on historical  
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10 deforestation data from the Project for Monitoring Deforestation in the Legal Amazon  
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12 (Prodes).  
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- 15 2. We used the Land Change Modeler, available in TerrSet software (version 18.31) to  
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17 estimate the risk of deforestation in the remaining forest area. The software estimated the  
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19 association of the deforested area with variables of interest for two periods considered in  
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21 this study: 1988-2016 and 2000-2016. The variables used to estimate the association  
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23 were: a) terrain and b) distance from the public land parcels calculated in IDRISI  
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25 software to: i) rivers, ii) old deforestation, iii) recent deforestation, iv) protected areas, v)  
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27 roads, vi) special areas (conservation units, indigenous lands, military areas), vi) areas of  
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29 federal settlement projects, vii) slaughterhouses and viii) areas under embargo for illegal  
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31 deforestation. To calibrate the model, we used the Relevance Weight (RW) method (17)  
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33 that estimated the importance of each variable for the deforestation risk map. The most  
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35 important variables according to RW were: distance from the public land parcels to i)  
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37 recent deforestation, ii) conservation units and indigenous lands, iii) old deforestation, iv)  
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39 areas of federal settlement projects, v) areas of federal settlement projects, and vi)  
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41 slaughterhouses (16).  
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- 44 3. We projected the areas of deforestation risk for two possible scenarios: i) the average  
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46 deforestation rate of 1988-2016 would continue and ii) the average deforestation rate of  
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48 2000-2016 would continue. The steps to estimate each scenario were as follow (16):  
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- a. We calculated the mean deforestation rate for the 1988-2016 and 2000-2016 periods from the deforestation data detected by PRODES in the Amazon biome;
- b. We combined the predictor variables with the 1988-2016 and the 2000-2016 land cover maps and generated deforestation risk maps. These maps show the similarity between the remaining forest and the previously deforested cells. The greater the similarity, the greater the risk of this cell being deforested in the future.
- c. Using the Top Rank tool in TerrSet we allocated the mean deforestation rates calculated in step 3a over the deforestation risk map. The Top Rank selected the cells with the highest deforestation risk until the final result for both scenarios: the 1988-2016 rate and the 2000-2016 scenario.

We estimated the carbon dioxide (CO<sub>2</sub>) emissions for the two future scenarios using the following approach. First, using the function Zonal Statistics from ArcGIS 10.3, we calculated for each scenario the total aboveground carbon (AGC) within the cells at risk of deforestation (18). Next, we converted the AGC to CO<sub>2</sub>, by multiplying by 44/12 (units of CO<sub>2</sub> per units of carbon). We assumed that all carbon was compromised by the future deforestation, which means that the CO<sub>2</sub> emissions would occur all at once. Due to the lack of data, we did not calculate the below-ground and soil carbon emissions nor the removals from forest regrowth.

## Results

### *Governmental revenue loss*

The estimated short-term governmental revenue loss for the sale of the 8.6 million hectares of public lands varies from US\$ 5 to 8 billion (Figure 1), considering the conversion rate of R\$3.72



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3 to US\$1.00. The potential future governmental revenue loss for the sale of the additional 19.6  
4 million hectares that may be privatized ranges from US\$ 16.7 to 23.8 billion (Figure 2).  
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7 Therefore, in total, the new land policy could lead to revenue losses of US\$ 31.7 billion. This  
8 amount corresponds to 7% of the Brazilian gross domestic product (GDP) in 2018 and more than  
9 a hundred times the annual budget of the Ministry of Environment.  
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13 Governmental land prices established by the new law represented in average 1.8% to 42% of the  
14 land's market value in the four scenarios of future revenue loss. This variation is based on the  
15 total discount applied in each scenario and whether the minimum, mean or maximum  
16 governmental land price applies in each scenario according to the legislation. Our results  
17 demonstrate that even the mean and the highest governmental price scenario are advantageous  
18 for the buyer. For instance, by paying 25% or 33% of market value (the mean governmental land  
19 prices in future and short-term scenarios, respectively), the title beneficiaries eliminate the risk of  
20 losing the property if they fail to comply with social and environmental requirements and can  
21 easily profit by selling the land for the market price.  
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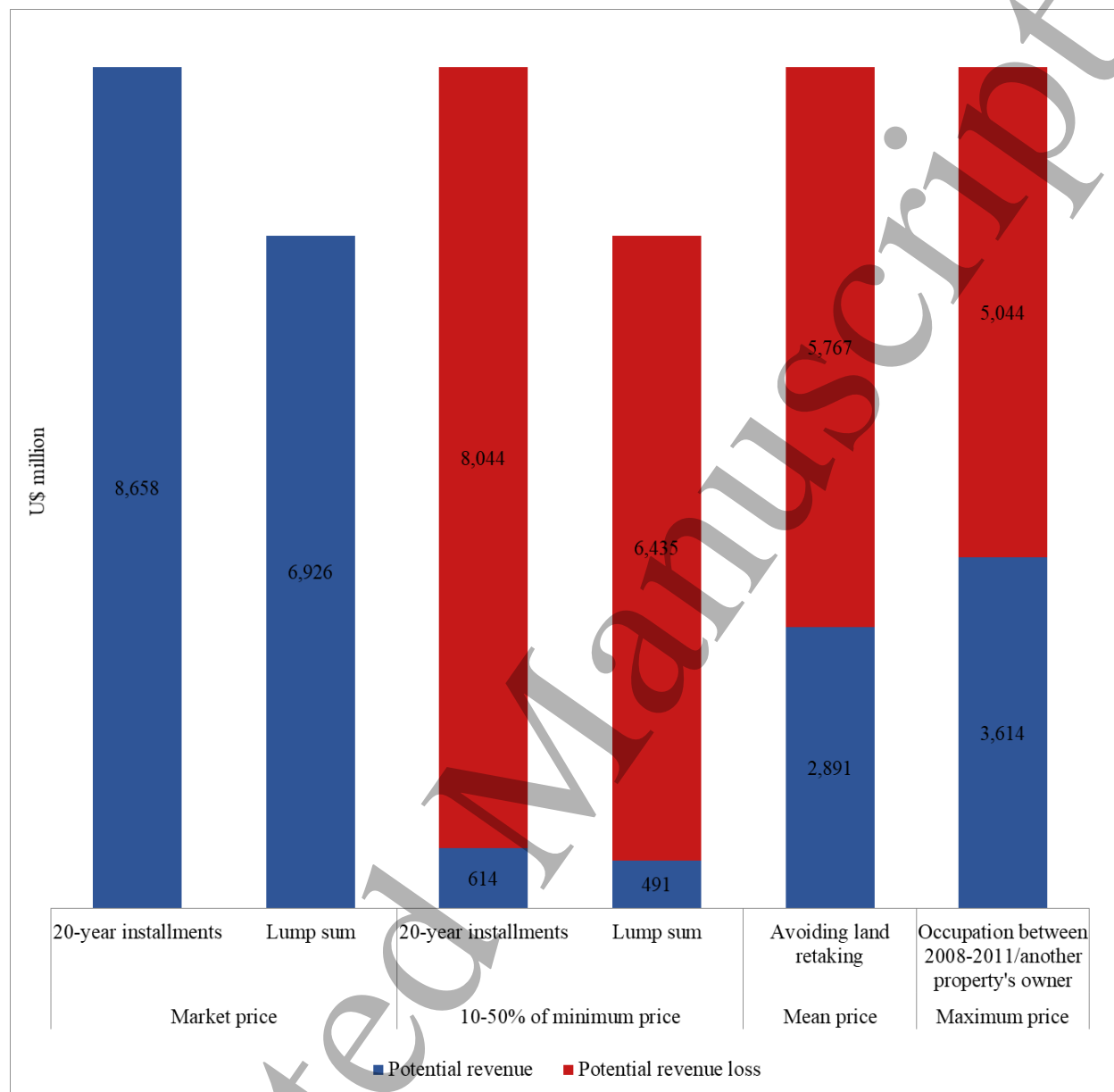


Figure 1: Estimated short-term revenue loss with regularization of 32,490 parcels occupied up to 2004 in the Amazon region

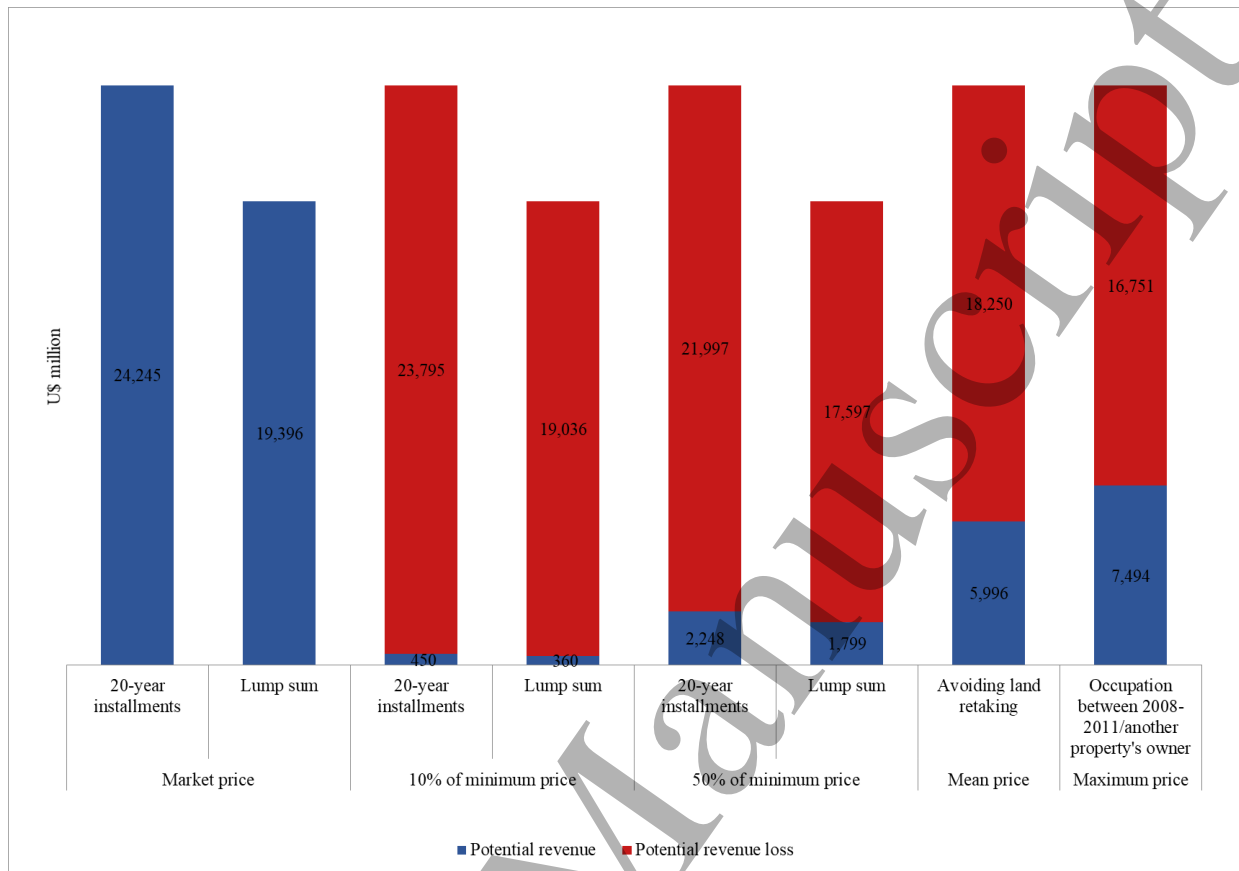


Figure 2: Estimated future revenue loss with regularization of 19.6 million hectares designated for private landholding regularization in the Amazon region.

#### *Risk of future deforestation and carbon emissions*

If all the 19.6 million hectares are allocated for future sale, between 1.1. to 1.6 million hectares are at risk of being deforested due to the cattle ranching frontier advance until 2027 (Figures 3 and 4). This forest loss could emit 4.5 to 6.5 megatonnes of carbon dioxide respectively. Such estimates are between three to five times above the targeted annual deforestation rate for the Amazon region by 2020 (339,000 hectares), according to the national climate change policy law.

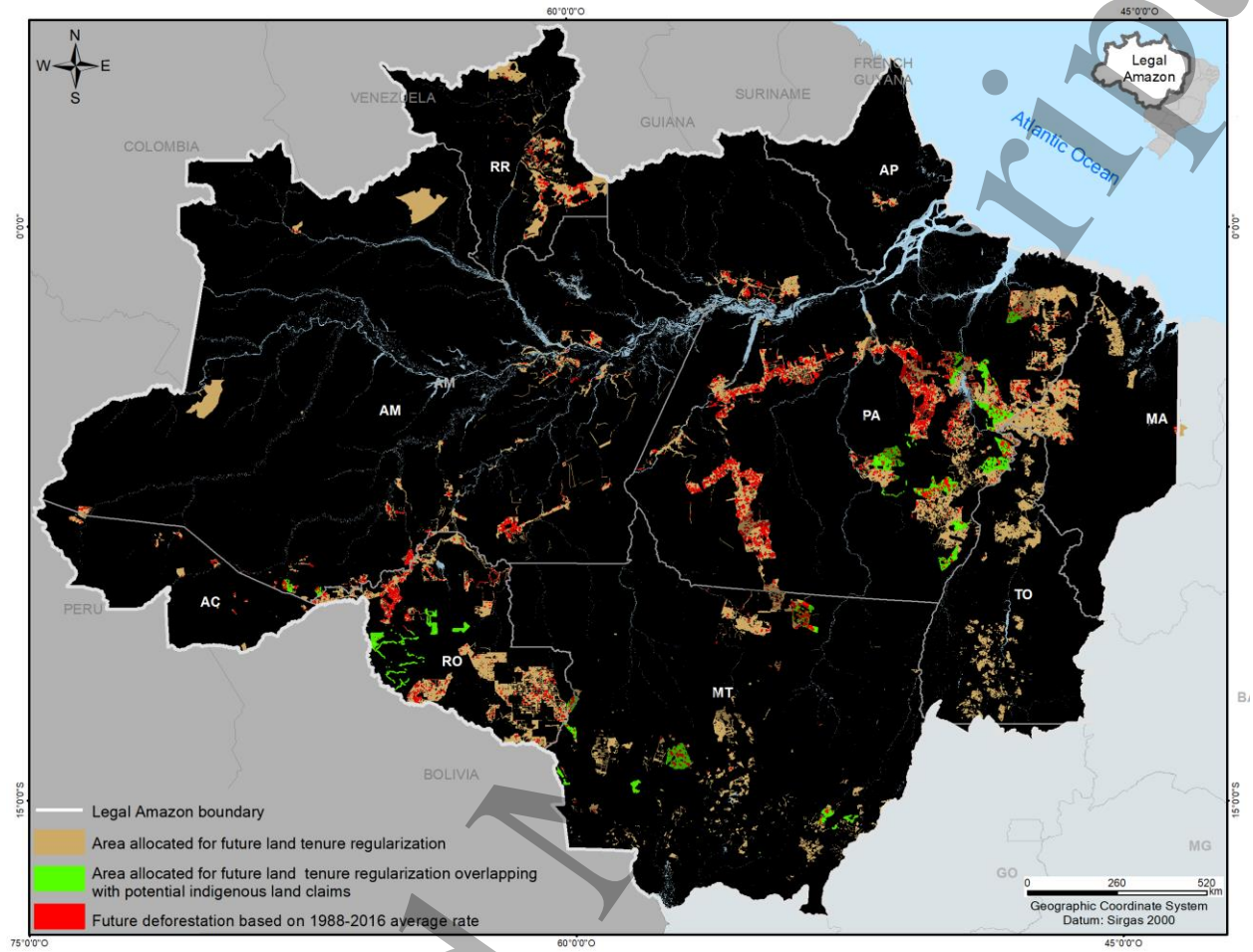


Figure 3: Deforestation risk in 19.6 million hectares allocated for future land regularization in the Brazilian Amazon based on the 1988-2016 rate

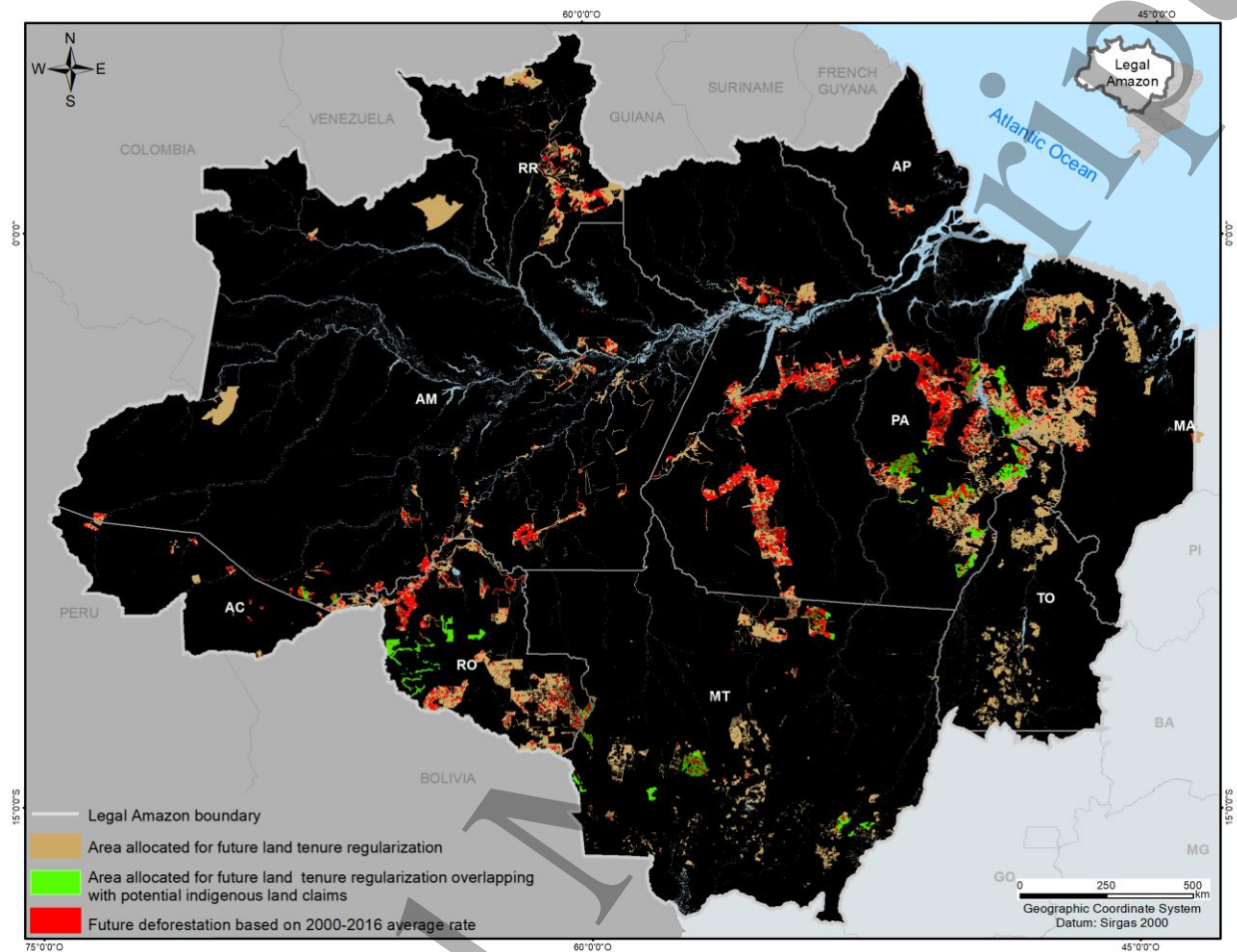


Figure 4: Deforestation risk in 19.6 million hectares allocated for future land regularization in the Brazilian Amazon based on the 2000-2016 rate

## Discussion

### *Increased risk to conservation and indigenous lands rights*

The new land policy repeats an old pattern of validating illegal grabbing of public lands and rewards the illegal occupants by selling land below market prices. As in the past, this situation is likely to lead to at least two negative impacts: i) loss of public revenues in the order of tens of billions of US\$ and ii) new illegal occupations of public lands associated with deforestation and land conflicts.

Beyond the financial and social conflict implications, this scenario is in stark contradiction to other federal and state conservation, human rights, and development policies. According to current Brazilian laws and policies, the allocation of public lands should prioritize granting land rights to indigenous peoples (a constitutional right) and traditional communities, as well as creating new conservation units, which is consistent with the national goals of reducing deforestation.

Thus, since one million hectares of the area allocated to privatization overlaps with potential indigenous land claims, the federal government should exclude such an area from its land privatization program. Even if the government still needs to conduct legally required studies to determine the extent of the claimed indigenous territories, such areas should become temporarily unavailable for other types of land allocation. This measure could prevent conflicts if the government issues private land titles in areas that could be later declared as indigenous territories.

In addition, to allow public scrutiny over decisions with socioenvironmental impacts in the Amazon, it is fundamental that the government continues to disclose spatially explicit datasets of its decisions on how to allocate lands in the region. The continuation of such a transparency practice is uncertain, since the new government attempted to make it easier for public officials to classify public data as secret (19). The executive order with such provision was revoked after much criticism, but this example raises concerns that some governmental decisions will no longer become easily available to the public.

#### *Freezing public land sale and improving legal mechanisms to decide land allocation*

In addition, a new wave of privatization of public lands in the Amazon could stimulate new illegal occupations over the 70 million hectares of non-allocated forest in the Amazon. The

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3 conservation of this area is paramount to meeting Brazil's commitments to the Paris Accord.  
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5 Thus, to prevent land grabbing and deforestation of such an area, the government should freeze  
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7 public land sales in the Amazon region, submit the decision about this area allocation for public  
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9 and scientific review and, if selling part of this area, charge market prices. The two first  
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11 measures could be done by expanding the use of an existing legal mechanism called Area of  
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13 Provisional Administrative Limitations (ALAP for its Portuguese acronym), a legal instrument  
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15 that freezes any type of land allocation over a certain area for seven months (19). Currently,  
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17 ALAP only applies to areas being considered for conservation units (20), but the legislation  
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19 could be changed to allow its use when deciding the most appropriate allocation to any  
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21 undesigned public forest. Thus, instead of pushing for private landholding regularization in  
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23 existing forest areas, the federal government should speed up the recognition of priority land  
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25 claims for indigenous groups, traditional communities and conservation targets to comply with  
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27 the Brazilian constitution and laws, as well as with Brazil's climate change mitigation goals.  
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### 32 33 **Conclusion**

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35 This study demonstrated that the 2017 land law in Brazil will have financial and  
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37 socioenvironmental costs to the country, as well as threaten the country's climate change  
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39 mitigation commitments if the deforestation advances over the 19.6 million hectares to be  
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41 allocated to privatization in the Amazon. The federal government can still prevent such perverse  
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43 effects by freezing new privatizations, increasing public land prices and prioritizing creation of  
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45 protected areas and land allocation to social and sustainable use. However, such measures to  
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47 avoid the estimated damages are unlikely to be implemented if two political factors remain: i) the  
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49 agribusiness lobby continues to hold enormous power such as they demonstrated by changing  
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3 laws to facilitate land grabbing and ii) the newly elected president of Brazil implements policies  
4 to freeze demarcation of indigenous lands, as he promised during his campaign.  
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## 8 **References and Notes:**

- 9  
10  
11 1. P. R. R. Rochedo *et al.*, The threat of political bargaining to climate mitigation in Brazil.  
12 *Nat. Clim. Chang.* **8**, 695–698 (2018).  
13  
14  
15
- 16 2. D. Phillips, Brazil records worst annual deforestation for a decade. *Guard.* (2018),  
17 (available at [https://www.theguardian.com/environment/2018/nov/24/brazil-records-](https://www.theguardian.com/environment/2018/nov/24/brazil-records-worst-annual-deforestation-for-a-decade)  
18 [worst-annual-deforestation-for-a-decade](https://www.theguardian.com/environment/2018/nov/24/brazil-records-worst-annual-deforestation-for-a-decade)).  
19  
20  
21  
22
- 23 3. C. S. Simmons, The Political Economy of Land Conflict in the Eastern Brazilian Amazon.  
24 *Ann. Assoc. Am. Geogr.* **94**, 183–206 (2008).  
25  
26  
27
- 28 4. S. Aldrich, R. Walker, C. Simmons, M. Caldas, S. Perz, Contentious Land Change in the  
29 Amazon's Arc of Deforestation. *Ann. Assoc. Am. Geogr.* **102**, 103–128 (2012).  
30  
31  
32  
33
- 34 5. Global Witness, At what cost? (2017), p. 70.  
35  
36
- 37 6. S. Sengupta, What Jair Bolsonaro's Victory Could Mean for the Amazon, and the Planet.  
38 *New York Times* (2018), (available at  
39 <https://www.nytimes.com/2018/10/17/climate/brazil-election-amazon-environment.html>).  
40  
41  
42  
43
- 44 7. J. Intrator, From Squatter to Settler: Applying the Lessons of Nineteenth Century US  
45 Public Land Policy to Twenty-first Century Land Struggles in Brazil. *Ecol. Law Q.* **38**,  
46 179–232 (2011).  
47  
48  
49  
50
- 51 8. L. J. Alston, G. D. Libecap, B. Mueller, Land reform policies, the sources of violent  
52 conflict, and implications for deforestation in the Brazilian Amazon. *J. Environ. Econ.*  
53 *Manage.* **39**, 162–188 (2000).  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 9. P. M. Fearnside, Land-Tenure Issues as Factors in Environmental Destruction in Brazilian  
4 Amazonia: The Case of Southern Pará. *World Dev.* **29**, 1361–1372 (2001).  
5  
6  
7
- 8 10. D. S. Brown, J. C. Brown, C. Brown, Land occupations and deforestation in the Brazilian  
9 Amazon. *Land use policy.* **54**, 331–338 (2016).  
10  
11  
12
- 13 11. B. Soares-Filho *et al.*, Role of Brazilian Amazon protected areas in climate change  
14 mitigation. *Proc. Natl. Acad. Sci.* **107**, 10821–10826 (2010).  
15  
16  
17
- 18 12. E. M. Nogueira, A. M. Yanai, S. S. de Vasconcelos, P. M. L. de Alencastro Graça, P. M.  
19 Fearnside, Brazil's Amazonian protected areas as a bulwark against regional climate  
20 change. *Reg. Environ. Chang.* **18**, 573–579 (2018).  
21  
22  
23  
24  
25
- 26 13. Brazilian Forest Service, Cadastro Nacional de Florestas Públicas - Atualização 2016  
27 (2017).  
28  
29  
30
- 31 14. C. Azevedo-Ramos, P. Moutinho, No man's land in the Brazilian Amazon: Could  
32 undesignated public forests slow Amazon deforestation? *Land use policy.* **73**, 125–127  
33 (2018).  
34  
35  
36  
37
- 38 15. IEG/FNP, *No Title* (IEG/FNP, São Paulo, 2017).  
39  
40
- 41 16. P. Barreto, R. Pereira, A. Brandão Jr., S. Baima, *Os frigoríficos vão ajudar a zerar o*  
42 *desmatamento da Amazônia?* (Imazon, Belém, 2017);  
43  
44 [http://www.imazon.org.br/PDFimazon/Portugues/livros/Frigorificos e o desmatamento da](http://www.imazon.org.br/PDFimazon/Portugues/livros/Frigorificos%20e%20o%20desmatamento%20da%20Amaz%C3%B4nia.pdf)  
45 [Amazônia.pdf](http://www.imazon.org.br/PDFimazon/Portugues/livros/Frigorificos e o desmatamento da)).  
46  
47  
48  
49  
50
- 51 17. F. Sangermano, J. R. Eastman, H. Zhu, Similarity weighted instance based learning for the  
52 generation of transition potentials in land change modeling. *Trans. GIS.* **14**, 569–580  
53 (2010).  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 18. O. Englund *et al.*, A new high-resolution nationwide aboveground carbon map for Brazil.  
4 *Geo Geogr. Environ.* **4**, 1–12 (2017).  
5  
6  
7  
8 19. J. LANGLOIS, Brazil puts in place new regulations to keep government data and  
9 documents secret. *Los Angeles Times* (2019), (available at  
10 <https://www.latimes.com/world/la-fg-brazil-secrecy-20190124-story.html>).  
11  
12  
13  
14  
15 20. B. Brito, thesis, Stanford University (2017).  
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