Is the **EU-MERCOSUR** trade agreement **DEFORESTATION-PROOF?**

Imazon 30 years

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Editorial design and cover
Luciano Silva
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Editorial review
Glaucia Barreto

Imazon - Amazon Institute of People and the Environment
Trav. Dom Romualdo de Seixas, 1698, Edifício Zion Business, 11º andar
Bairro: Umarizal, Belém (PA), CEP: 66.055-200 • Tel.: (91) 3182-4000
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Authors by alphabetical order

Angel Aguiar has a Ph.D. in Agricultural Economics from Purdue University, M.S. in Agricultural Economics from the University of Idaho, and a Bachelor in Business and Economics from the University of Idaho. Angel began his Economics course work at the Pontificia Universidad Católica del Ecuador. He has been cited 2,445 times, Google Scholar.

Eugênio Arima is an associate professor in the Department of Geography and the Environment at the University of Texas at Austin. His research lies in the intersection of land change science, spatial quantitative analysis, and landscape ecology, with regional emphasis in Latin America and the Caribbean. He received his Ph.D. in geography from Michigan State University and an M.S. in agricultural economics from Pennsylvania State University.

Farzad Taheripour. Taheripour is an associated professor in the department of Agricultural Economics at Purdue University. He received his Ph.D. from the University of Illinois at Urbana-Champaign in 2006. Farzad's research interests are in energy, agriculture, policy analysis, and economic modeling. He has over 110 professional publications including journal papers, book chapters, conference papers, and reports. His research has been cited by about 2,700 times as of the end of September 2020. He is a leading researcher in economic modeling and is the GTAP Research Fellow for the term of 2017-2020.

Paulo Barreto is an associate researcher at IMAZON (Amazon Institute of the People and The Environment) a not for profit institute in Belém, Brazil. His research focuses on the drivers of land-use change in the Brazilian Amazon and the efficacy of policies to simulate forest conservation. His studies evaluated the impact of timber harvesting, the costs and benefits of forest management for timber production, the expansion of cattle ranching and the performance of the application of environmental laws and market policies to curb deforestation. Barreto holds a Master of Forest Sciences from Yale University (USA) and a BS in Forestry from the Federal Rural University in Belém (Brazil). As of November 2020, his publications reached 5,960 citations according to Google Scholar.

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Summary

Executive Summary

In June 2019, the European Commission and the Mercosur countries agreed on a trade-agreement (EMTA) that, once ratified by participating countries, is expected to increase commerce in agricultural products between the two regions. The trade deal will eliminate 93 per cent of tariffs for Mercosur products to the EU, notably benefiting agricultural products, including beef and soy.

Concerns have been frequently raised about the risk of increased deforestation in the Mercosur region – especially in the Brazilian Amazon. Such worries are pertinent given that an analysis of 189 countries from 2001 to 2012 shows that deforestation increased significantly over the three years after the enactment of free trade agreements (Abman & Lundberg 2020). Nevertheless, the proponents of the EMTA have argued that the deforestation risk could be mitigated because of the provisions of its Trade Sustainable Development Chapter and the recommendations provided by the Sustainability Impact Assessment.

> "…an analysis of 189 countries from 2001 to 2012 shows that deforestation increased significantly over the three years after the enactment of free trade agreements…"

However, this report shows that deforestation could increase in the Mercosur countries due the increased demand for agricultural products (Chapter 1) and could affect sensitive regions in Brazil, including areas neighboring indigenous lands and conservation units (Chapter 2). Moreover, Chapter 3 provides evidence that the EMTA's Trade and Sustainable Development provisions are insufficient to mitigate the increased risk of deforestation focusing on the Brazilian case. Therefore, the current agreement may not promote sustainable development as required by the EU trade regulation. Chapter 3 presents

seven recommendation to reduce the risk that the ratification of the current EMTA would result in additional deforestation and conflicts with indigenous populations. Following are the main results.

CHAPTER 1.
THE EMTA WILL INCREASE THE RISK OF ADDITIONAL DEFORESTATION IN MERCOSUR COUNTRIES

This chapter shows that deforestation could increase between 122 thousand 260 thousand and hectares in the Mercosur countries, according to the six alternative scenarios examined. Fifty-five percent of the deforestation would be in Brazil, considering the average of the six scenarios (ranging from 45% to 66%).

The scenarios combined assumptions relative to trade elasticities, level of land governance and the adoption or not of double cropping. Deforestation would be higher in a scenario of higher trade elasticity, less effective land governance, and no use of double cropping. In response to the trade liberalization, processed livestock products, beverage and sugar sectors from Mercosur increase production that is then exported to the EU. Conversely, the EU would decrease its output of these products due to increased competition. The land emissions vary from 75 million metric tons of CO2e from the first scenario (S11) to 173 million metric tons in the last scenario (S23).

The EMTA would generate welfare gains (in terms of producers and consumers monetary gains) of nearly 2.2 billion Euros for both EU-Mercosur regions. The EU would capture 68% of the gains, Brazil 23% and the remaining 9% would go to other Mercosur countries.

The trade impacts, land use changes, and welfare implications were estimated using an advanced version of a Computable General Equilibrium (CGE) model (GTAP-BIO). This model represents the structure of the global economy and traces production, consumption, and trade of all types of goods and services (including but not limited to crops, livestock products, vegetable oils and meals, sugar, processed rice, and processed food items) at the global scale. To implement the EMTA, the actual proposed tariffs changes were exogenously introduced into this model.

CHAPTER 2.
THE EMTA WOULD RISK DEFORESTATION IN SENSITIVE AREAS IN THE BRAZILIAN AMAZON AND CERRADO

This chapter projects where the additional deforestation would likely occur in the Cerrado and Amazon biomes in Brazil. These biomes accounted for 96,7% of the total deforestation in Brazil in 2019. Although not all the projected deforestation would be in Brazil and/or within a single biome, the analysis is useful to highlight the priority areas for mitigation.

In the Brazilian Amazon, deforestation is more likely to occur in three states: Pará (39.9%), Rondônia (32.6%), and Mato Grosso (25.2%). The EMTA would add the risk of deforestation in the vicinity of Indigenous lands and conservation units. Deforestation has been increasing rapidly in these areas, a likely consequence of reduced law enforcement operations and prospects for exploiting those areas for commercial purposes.

In the Cerrado, deforestation would be concentrated in its northeastern region or MATOPIBA. Maranhão is predicted to house 31.6% of the total deforestation, followed by Piauí (21.3%), and Bahia (20.4%). The EMTA would increase the risk of deforestation alongside protected areas in the Cerrado. We identified two critical regions: i) Maranhão where several Indigenous reserves and one national park are next to hotspots of deforestation; and ii) Mato Grosso, in the ecotone between the Cerrado and Amazonia, where three Indigenous reserves are close to the deforestation frontier.

Two steps were used to project the location of future deforestation. First, the authors estimated the probability of a given area to be ever deforested based on factors associated with deforestation from 2001 to 2018. The second step was to allocate the projected deforestation from Chapter 1 along the existing forest landscape (post-2018). This phase consisted of i- ordering the remaining (post-2018) forested pixels from highest to lowest deforestation probabilities and ii- selecting the top pixels until the sum of the area of those pixels reached the total potential deforested area predicted by the GTAP-BIO model.

CHAPTER 3.
THE CURRENT EMTA ENVIRONMENTAL PROVISIONS ARE INSUFFICIENT TO MITIGATE THE RISK OF DEFORESTATION

This chapters show that the current EMTA environmental provisions are insufficient to mitigate the risk of deforestation.

The Trade and Sustainable Development Chapter (TSDC) calls for the effective implementation of the Paris Agreement. However, the EU and Mercosur climate mitigation targets are below what is needed to hold temperature increase well below 2°C, according to scientists. In Brazil's case, the pledge to zero illegal deforestation has been placed in a distant future: 2030.

Moreover, the TSDC lacks sanctions, and the space for civil society participation is limited. The dispute settlement process is lengthy (460+ days), which favour non-compliant actors.

To uphold sustainability, development, and human rights principles, the EMTA should condition its ratification to improved performance of policies and creation of new provisions. The focus of prevention is essential given the potential irreversible and long-term nature of land use impacts associated with the EMTA (deforestation and violent conflicts).

The following recommendations are consistent with the European Parliament resolution from September 16, 2020, on the EU's role in protecting and restoring the world's forests (European Parliament 2020). The resolution i- reiterates that EU trade and investment policy should include binding and enforceable sustainable development chapters and ii- stresses that clear commitments to the fight against deforestation should be included in all new trade agreements including Mercosur.

1. **Condition the ratification of the agreement to actual deforestation reduction**. The ratification or the start of EMTA tariff reductions should be contingent on Brazil reducing its deforestation according to the country's National Climate Change Policy target: 3,900 km^2 (390,000 hectares). Given that Brazil will not meet its 2020 target, the EMTA should wait

until such baseline is eventually reached in the future. To achieve this target, Brazil would need to resume the successful program (PPCDAM) and deploy other market and regulatory approaches such as traceability of high-risk commodities.

2. **Create a fund to support reduced deforestation and forest degradation policies**. The ratification or the inception of tariff reductions should be conditioned to the deployment of technical and financial assistance such as the creation of a fund to support sustainable. These funds should focus on regions with highest risks of direct and indirect deforestation taking into account the likely displacement of land-use change – for example, increased land-use intensification in one region leading to an expansion of deforestation in other areas.
3. **Consult and secure indigenous people's rights**. The EU should condition the ratification of the agreement to proper consultation of indigenous peoples and the establishment of secure land rights and adequate protection of indigenous lands territories according to United Nations Declaration on the Rights of Indigenous Peoples. In practice, this would entail that indigenous territories should be demarcated, and invaders should be relocated/evaded before tariff reductions.
4. **Establish legally binding sanctions to address non-compliance**. The TSD chapter should establish legal binding sanctions similar to

what is provisioned for other issues in the EMTA. It is worth noting that trade agreements that use sanctions to settle disputes, such as USA agreements, have stimulated the adoption of best practices before trade agreements are ratified. However, even if the TSDC provisions were binding, the long process to address violations would be insufficient to curb the surge of deforestation.

5. **Establish time-bound responses to EMTA violations**. The Parties should reduce the duration of the environmental dispute settlement. The EMTA could consider the model of the United States - Mexico - Canada Agreement (USMCA) that created a Rapid Response Labor Mechanism in charge of quick monitoring and enforcement of provisions.
6. **Establish mandatory best practices**. Given the current systemic failures of environmental policy in Brazil, the EMTA should require the adoption of best practices such as independent certification, traceability of products, due diligence, and consultation with indigenous communities before investing.
7. **Expand and improve the scope for civil society participation**. Echavarría et al. (2020) recommend the EMTA to expand and enhance the scope for civil society participation, including involvement in TSD sub-committees, creation of mechanisms for dialogue with governments, provision of funding so civil society can monitor implementation and participate of meetings.

Chapter 1.

The impact of the EU-Mercosur trade agreement on land cover change in the Mercosur region

Farzad Taheripour and Angel H. Aguiar[1]

[1] Research Associate Professor and Research Economist, respectively. Department of Agricultural Economics, Purdue University.

INTRODUCTION

In June 2019, the European Commission and the Mercosur countries agreed on a trade agreement in principle that, once ratified by participating countries, is expected to increase commerce in agricultural products between the two regions. The trade deal will eliminate 93 per cent of tariffs for Mercosur products to the EU, notably benefiting agricultural products, including beef and soy. During the long negotiation phase, concerns have been frequently raised about the risk of increased deforestation in the Mercosur region – especially in the Brazilian Amazon, Brazilian Cerrado, and the Chaco of Argentina and Paraguay.

To address environmental concerns, the agreement promotes monitoring of agricultural products' supply chains, such as through the Soy Moratorium. However, supply chain management is not yet capable of dealing with all the deforestation risks. Tracking the direct supply of agricultural products and beef may curb direct deforestation, but the risk of leakages and indirect deforestation may increase through the following pathways:

1. Agricultural encroachment in underutilized/low productivity pasturelands to satisfy new demand will raise land prices, displacing ranchers to tropical forests, which will then be deforested for cattle ranching (Henders et al. 2015).
2. Beef produced in areas compliant with supply chain agreements that supplied the domestic market are exported. Cattle ranchers open new pasturelands through deforestation to supply the resulting production deficit in the domestic market (Byerlee et al. 2017, Henders et al. 2015).
3. The risks may also increase due to the possibility of increased exports stimulating the deregulation of land use to make more land clearing legal. For example, the current Brazilian government has promised to open Indigenous land for commercial use and the Brazilian Congress is considering a proposal to facilitate the licensing of land use, including deforestation.

This report evaluates land-use changes in the Mercosur countries resulting from EU's reduced tariffs on agricultural products and the elimination of export taxes on Argentinian soybeans. Our main goal is to estimate induced land-use changes due to this trade agreement. Induced land-use changes could occur inside or outside the Mercosur region. Land-use changes include all types of land transformation across uses (e.g. conversion of forest to pasture or cropland, pasture to cropland, cropland to pasture, conversion of idle land to crop production and so on).

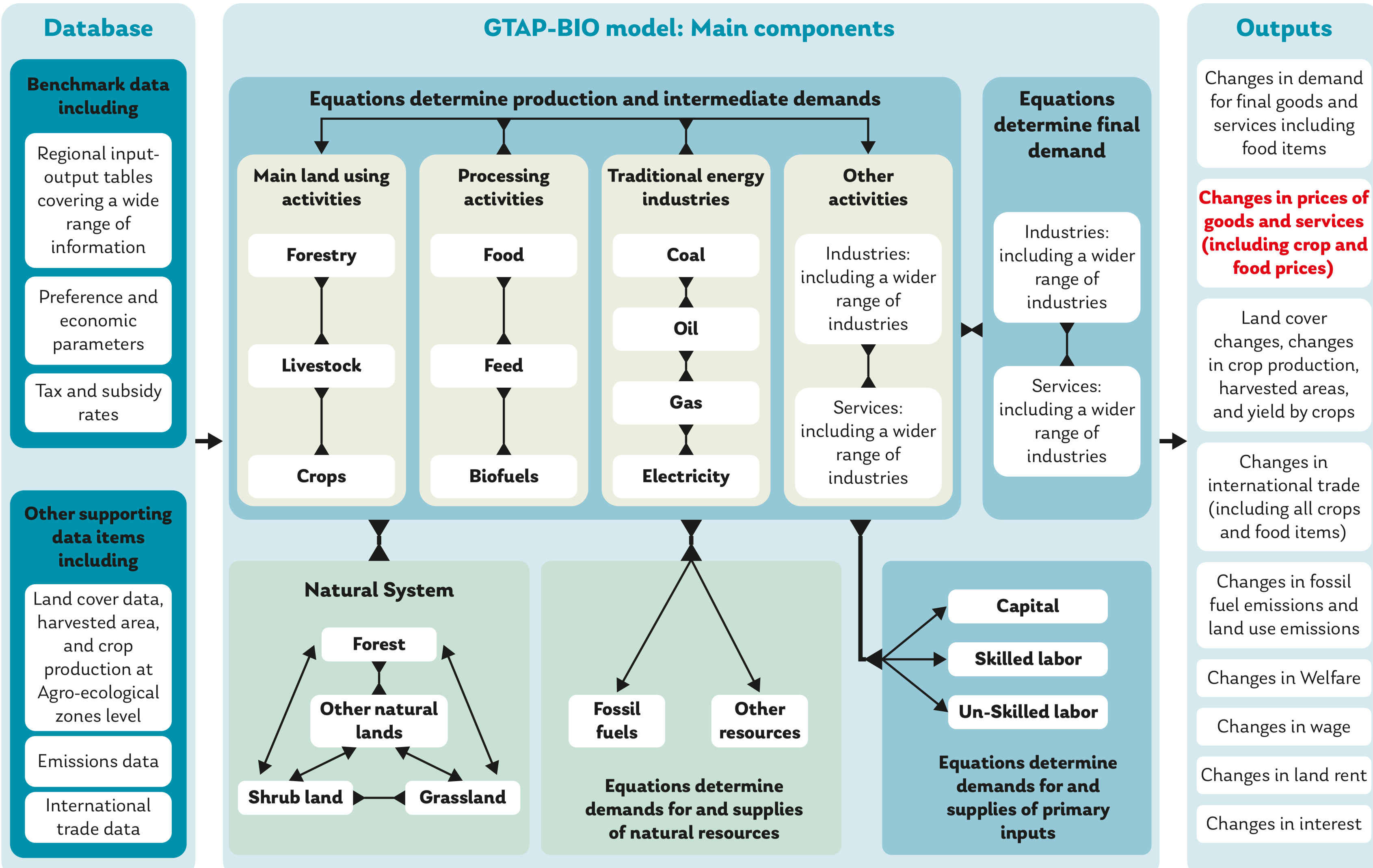
METHODS

Modelling approach

Given the complexity of the world markets and land use, and land allocation, competition among producing regions, and potential substitutability of products, we will use a well-known Computable General Equilibrium (CGE) model, which has been frequently used to examine trade-energy-environmental issues: GTAP (Hertel 1997). A more advanced version of this model (GTAP-BIO) has often been used to assess induced land-use changes due to energy and trade policies (Hertel 2010, Yao et al. 2018, Taheripour and Tyner 2018). In this research, we will use and extend the model reported in Taheripour and Tyner (2018). Figure 1-1 represents the major components of this model.

In general, the GTAP-BIO model represents the structure of the global economy and traces production, consumption, and trade of all types of goods and services (including but not limited to crops, livestock products, vegetable oils and meals, sugar, processed rice, and processed food items) at the global scale. It traces land uses (forestry, pastureland, cropland) and allocation of land across crops by country and Agro-Ecological Zones (AEZ) at the global scale. The model reported by Taheripour and Tyner (2018) takes into account multiple cropping and the potential to return idle land to crop production. It divided the world into six regions: the US, the EU, Brazil, the Rest of South America, China and the Rest of the World (Others). The Rest of South America represents the main members of Mercosur (Argentina, Paraguay, Uruguay, and Venezuela) and the remaining countries in South America (Bolivia, Chile, Colombia, Ecuador, and Peru).

Figure 1-1. The main component of the GTAP-BIO model.



The model is able to attribute changes in land use from a shock in the economic system, which in our case is the reduction of trade barriers among Mercosur-EU countries. Therefore, one can infer the impact of the "policy change scenario" by comparing the output and land use from a current base case scenario. The GTAP-BIO model can also simulate the effect of good governance through changes in the elasticity between agricultural production and deforestation. This is relevant to the Brazilian case because environmental enforcement efforts have varied substantially between administrations in the past two decades. Studies have shown that environmental enforcement can reduce deforestation substantially, for more details, see Taheripour et al. (2019) and its supporting documents.

The GTAP-BIO model versions are capable of tracing the economic impacts of trade agreements and disputes that affect tariffs only. Given that the EU-Mercosur trade agreement (EMTA) involves tariffs and quotas, we altered the model to accomplish this task, following the approach proposed by van der Mensbrugghe (2020).

When compared against a sustainable impact assessment (SIA) as described in the SIA Study of the Euro-Mediterranean FTA[2], our approach considers economic and environmental impacts, but it does not address the just drop this or social effects.

Examined scenarios

To examine the land use impact of EMTA, we developed two sets of scenarios. The first set (see row 1 in Table 1-1, including S11, S12, and S13) represents three scenarios that use the GTAP standard trade elasticities[3]. The second set (see row 2 in Table 1-1, including S21, S22, and S23) uses larger trade elasticities for those commodities and products that are subject to the EMTA[4]. The examined scenarios consider the full implementation of the agreement by all Mercosur countries. Results will be different if, for example, Brazil ratified the agreement without other countries in Mercosur.

[2] Available at https://trade.ec.europa.eu/doclib/docs/2005/january/tradoc_121165.pdf
[3] GTAP uses a set of standard trade elasticities that for details see: Hertel and van der Mensbrugghe (2019).
[4] For the targeted commodities and products, we used 5 and 10 for ESUBD and ESUBM, respectively. These are relatively large elasticities and allow fast transition in trade between regions.

In each set, we examined three cases which represent different land governance scenarios. The first scenario of the first set (S11) uses a set of land transformation elasticities that characterize an effective land governance policy in Brazil. These parameters were tuned to the observed land-use changes across the world for the time period 2003-2013. In this period, the deforestation rate in Brazil has followed a declining trend due to a set of strong land governance practices (Byerlee et al. 2017). In addition, the rate of multiple cropping has increased in this time and more idled land returned to crop production in Brazil. The S11 simulation represents this land governance environment. The second simulation of the first set (S12) repeats the first scenario but uses a set of land transformation elasticities that represents Brazil before 2013 when the rate of deforestation was high in this country. In the first set, the last scenario (S13) repeats the second scenario but assumes no multiple cropping in Brazil. Finally, the second set of cases (S21, S22, and S23) repeat their corresponding cases of the first set with higher trade elasticities.

Table 1-1. Examined scenarios.

Description	Low deforestation with multiple cropping	High deforestation with multiple cropping	High deforestation and no double cropping
Standard GTAP trade elasticities	S11	S12	S13
Higher trade elasticities for targeted products	S21	S22	S23

Implemented tariffs and quotas

The first step in our implementation was to verify the baseline tariffs and export taxes to make sure that they accurately represent the existing tariffs and taxes in the base year. We accomplished this task and observed some minor mismatches. The alter tax program (Malcolm 1998) is then used to update the base data to represent accurate tariffs and taxes. In the next step, to implement the EMTA, we applied the following shocks:

- Elimination of the export tax on soybeans from the Rest of South America (includes Argentina) to the EU.
- Rest of South America and Brazil eliminate import tariffs on EU's soybeans.
- EU eliminates import tariffs on ethanol from Mercosur (Brazil and Rest of South America).
- EU reduces specific import tariff on pork and eliminates the import tariff for poultry to exports from Mercosur. Further, for poultry a quota is introduced, the out-of-quota tariff remains at baseline.
- The EU eliminates the in-quota tariff for sugar from Brazil up to the quota level, which does not change. The EU also eliminates the in-quota tariff for sugar from Paraguay and introduces a new quota. Out-of-quota tariffs remain at baseline.
- EU reduces in-quota tariffs for beef exported from Mercosur. The quota for frozen and fresh beef is divided equally among Mercosur members. Elimination of in-quota tariffs on high-quality beef is considered and their quota level, specific by Mercosur country, maintained.
- Mercosur eliminates import tariffs to dairy products from the EU.
- Mercosur eliminates import tariffs to EU cars, parts, clothing, chemicals, machinery, pharmaceuticals, and textiles.

RESULTS

Welfare impacts

The GTAP-BIO model calculates monetary values of gains and losses induced by changes in markets for goods, services and primary inputs, in terms of regional equivalent variation (EV) to measure changes in economic welfare (Hertel 1997). This concept takes into account gains and losses due to changes in trade. The EMTA affects the economies of the EU, Brazil, the Rest of South America and also other countries across the world. Table 1-2 shows the welfare impacts by region[5]. This table suggests that across all examined scenarios, the EMTA generates welfare gains for the EU, Brazil, and the Rest of South America. The EU is the

[5] Tables and Figures displayed in US dollars are being converted to Euros in the Appendix I.

big winner. Brazil and R.S. America would also benefit according to the simulations. On the other hand, the US, China, and others lose welfare due to the EMTA. The sum gains for the EU, Brazil, and R. S. America is larger than the sum of losses for the US, China, and other countries. Therefore, the global welfare would be higher.

The welfare impacts vary across cases. In general, the cases with larger trade elasticities represent more gains for the EU, Brazil and the R. S. America. On the other hand, the changes in the land governance conditions in Brazil barely affect welfare impacts. Changes in land governance mainly affect welfare in Brazil. The stronger the land governance forces the more gains for Brazil. Under a more robust land governance condition, farmers in Brazil use more idle land and that generates more gains than deforestation.

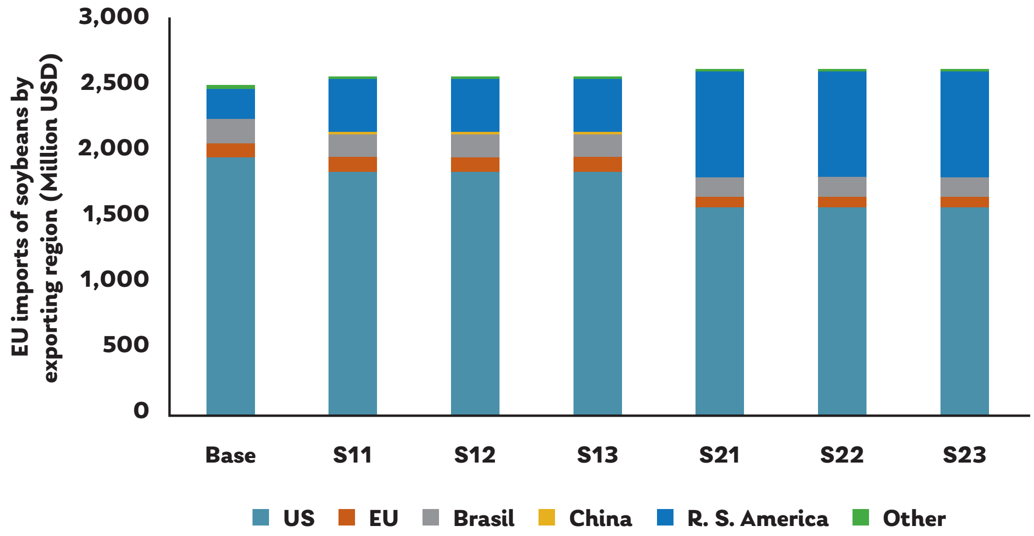
Table 1-2. Welfare impacts (EV) of the EMTA (Million USD).

Region	S11	S12	S13	S21	S22	S23
EU	1,643	1,648	1,648	1,719	1,727	1,728
Brazil	583	572	570	608	589	587
R. S. America	208	204	204	247	239	239
US	-432	-435	-435	-441	-448	-448
China	-672	-661	-660	-802	-783	-781
Other	-990	-986	-985	-1,080	-1,071	-1,070
Total	**341**	**342**	**342**	**251**	**254**	**254**

Trade impacts

According to our simulation, the EMTA decreases soybeans exports from Brazil (and also from the USA) to the EU. But it largely extends soybean exports from the R. S. America to the EU (Figure 1-2). According to our simulations, there could be an overall increase in EU imports of between 2.6% and 5% relative to the baseline. There is a clear substitution taking place when the export taxes from Argentina are eliminated. This does not happen immediately, but it is expected that the EU will switch towards the low-cost alternative. As expected, in the simulation, the larger increase and trade diversion towards R. S. America occurs when we consider higher trade elasticities.

Figure 1-2. EU imports of soybeans by exporting region for all examined scenarios (Million USD).



With respect to processed livestock, the implementation of a tariff rate quota prevents the increase of EU imports from Mercosur. Figures 1-3 and 1-4 show the imports of processed beef and processed pork and poultry, respectively. Overall, the EU imports increased marginally by 0.3% for beef and approximately 1% for pork and poultry. The tariff reduction does promote an increase in trade from the Mercosur countries, which comes a little at the expense of intra-EU trade. EU imports of beef from the EU are 70% on the base and after simulations, this falls by less than a 1% point, if only the tariff reduction is considered. In terms of pork and poultry, the EU baseline records 87% of total EU imports, which could decrease by 3% points. It is important to note that the effect of the tariff reduction would have resulted in stronger exports from Mercosur, but this is halted because of the quota.

Figure 1-3. EU imports of beef by exporting region for all examined scenarios (Million USD).

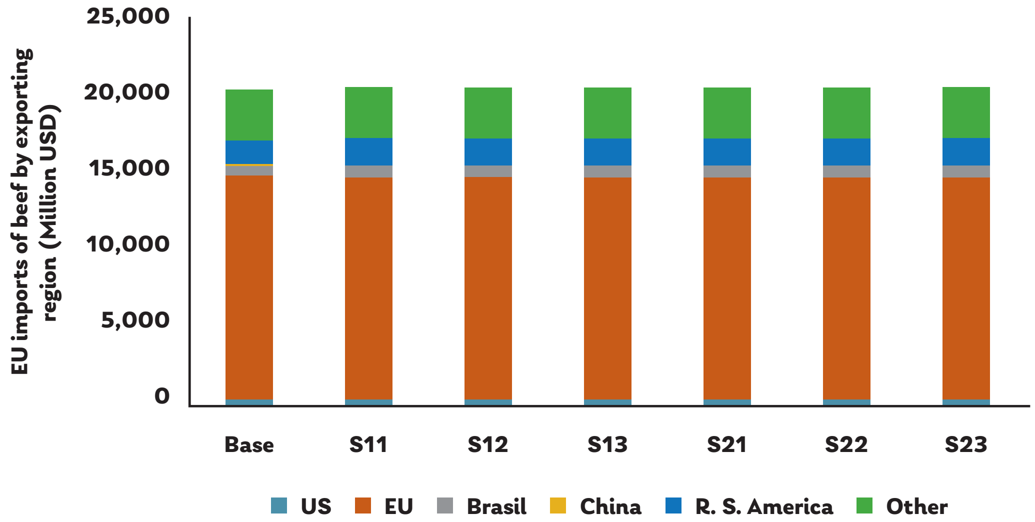
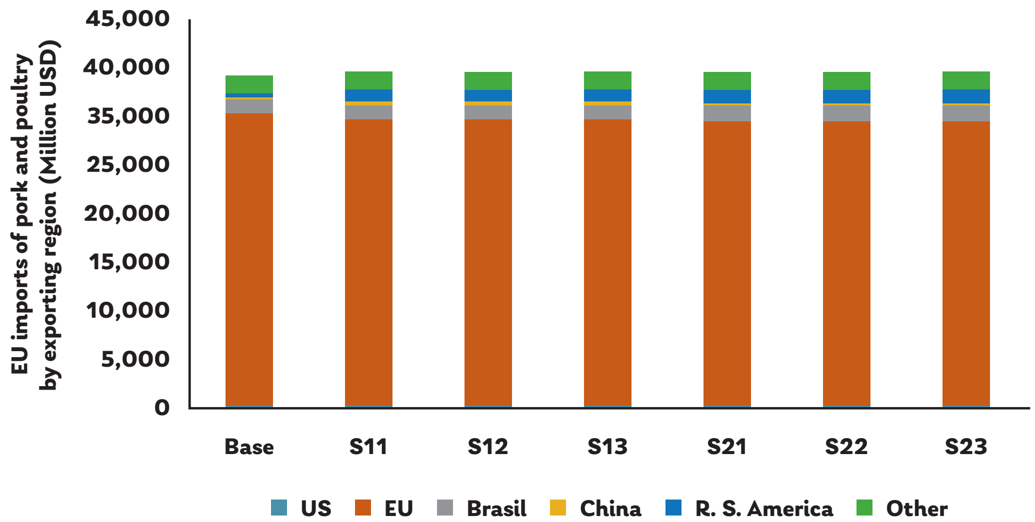


Figure 1-4. EU imports of pork and poultry by exporting region for all examined scenarios (Million USD).



For sugar (included in the beverage and sugar sector), the EMTA will increase the share of Mercosur exports to the EU moderately as depicted by Figure 1-5. Intra-EU trade remains over 74% of the total EU imports of beverages and sugar. Figure 1-6 highlights the EU imports of sugar from Mercosur countries only.

Figure 1-5. EU imports of beverages and sugar from exporting regions for all examined scenarios (Million USD).

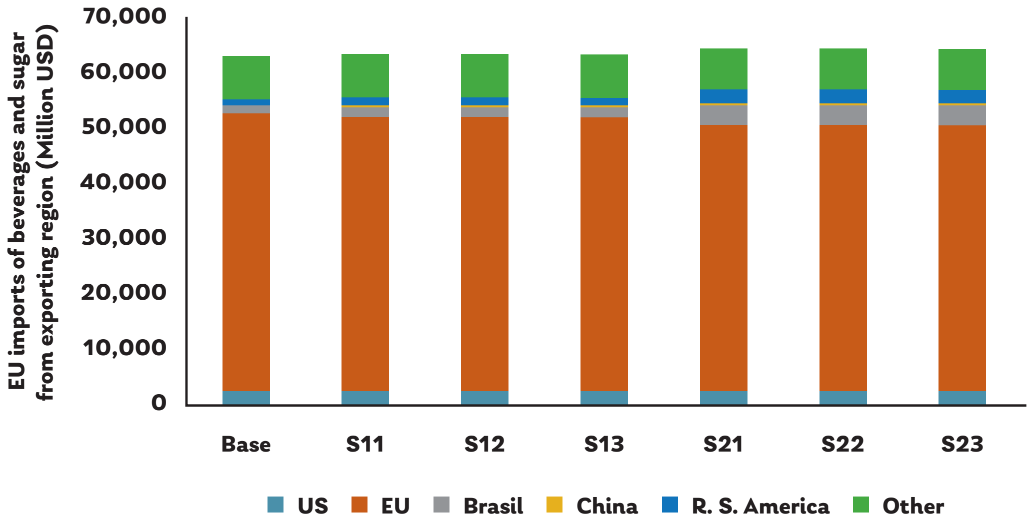
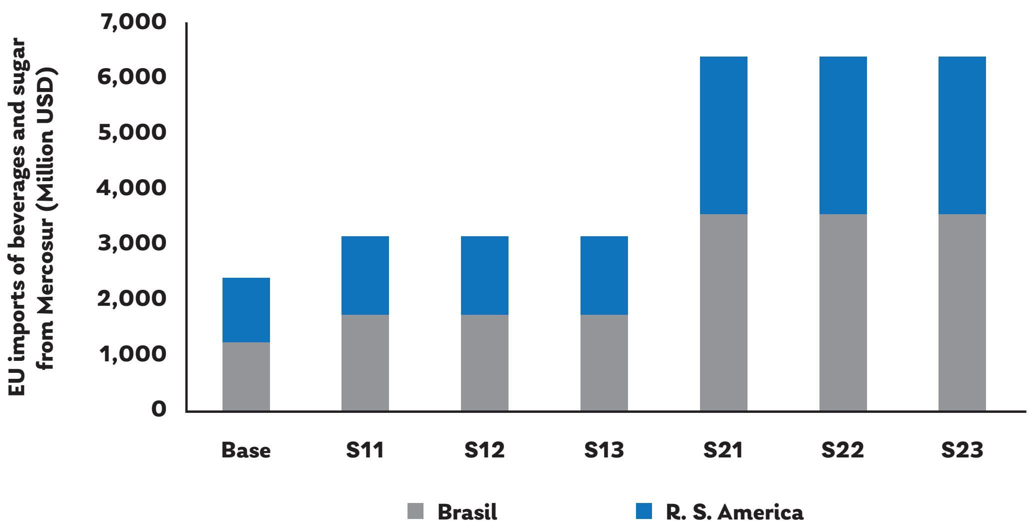


Figure 1-6. EU imports of beverages and sugar from Mercosur (Million USD).



Finally, the reduction of Mercosur tariffs on processed dairy and other industrial sectors[6] causes the increase of European exports to the Mercosur region, as shown in Figures 1-7 and 1-8, respectively.

Figure 1-7. Mercosur imports of processed dairy from the EU (Million USD).

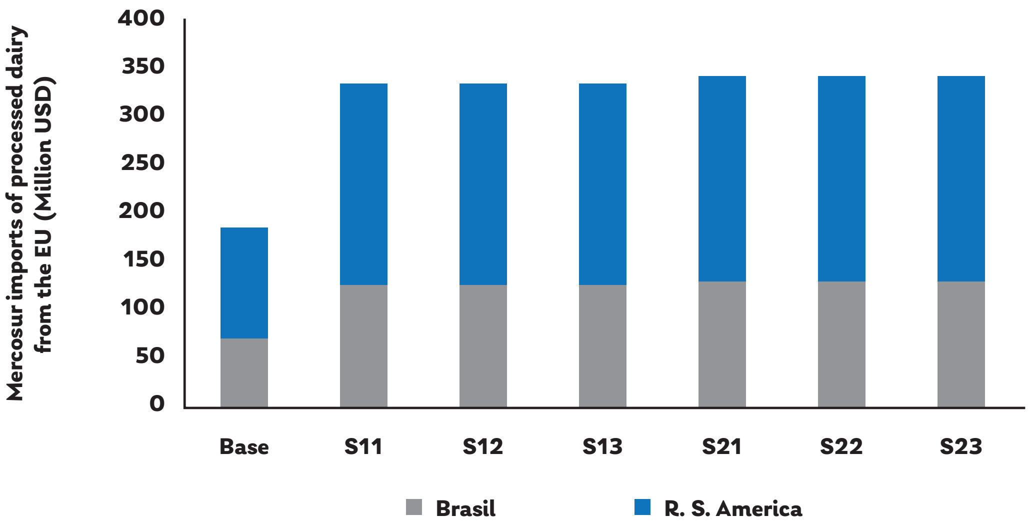
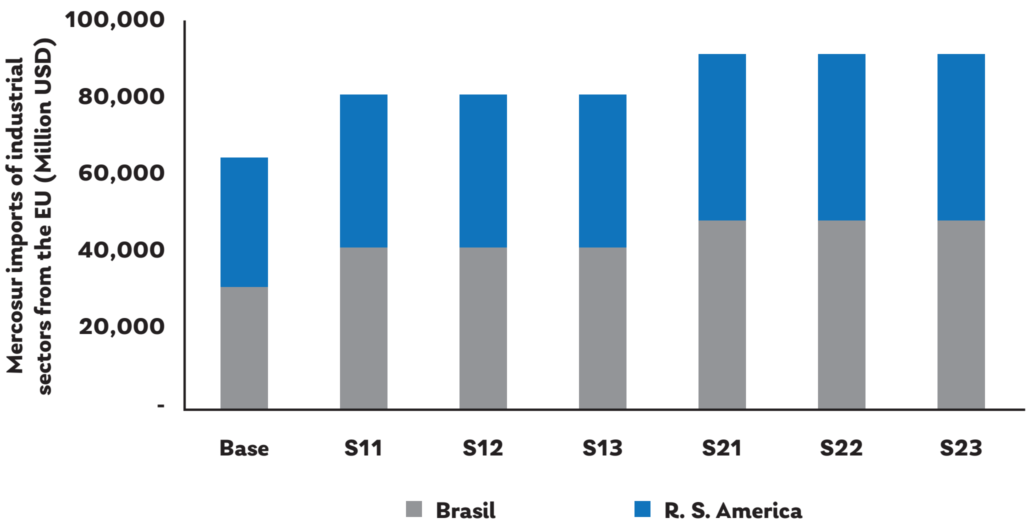


Figure 1-8. Mercosur imports of industrial sectors from the EU (Million USD).



[6] Includes cars, parts, machinery, chemicals, clothing, pharmaceuticals and textiles.

Impacts on production

Table 1-3 shows the effects of the EMTA on the sectors directly affected. In response to the trade liberalization, processed livestock products, beverage and sugar sectors from Mercosur would increase production that would then be exported to the EU. Conversely, the EU decreases its output of these products due to increased competition. Similarly, the reduction of Mercosur tariffs to EU dairy products and other EU industrial sectors allows the EU to make gains in the Mercosur market, increasing EU exports to Mercosur countries, and consequently increasing EU output. This increased competition also causes the Mercosur bloc to reduce its output of dairy and other industrial sectors.

For sugarcane ethanol, the EU's reduction of import tariffs causes Brazilian exports of ethanol to increase under all scenarios. It follows that output should increase and it does for all except under scenario S21, that is the low deforestation with multiple cropping and high trade elasticities scenario. Under this scenario, exports are able to increase while output decreases because domestic sales also decrease. The model also shows an unexpected reduction of output in other Mercosur countries. The initial data, however, reveals that Brazilian ethanol exports into the EU represent 99.99% of total EU's ethanol imports.

"For sugarcane ethanol, the EU's reduction of import tariffs causes Brazilian exports of ethanol to increase under all scenarios..."

Table 1-3. Percent changes in the production of affected sectors by the EMTA.

Region	Commodity	S11	S12	S13	S21	S22	S23
EU	Soybeans	-0.761	-0.766	-0.767	-5.718	-5.747	-5.750
Brazil	Soybeans	0.173	0.211	0.214	-0.064	0.027	0.036
R.S. America	Soybeans	0.303	0.298	0.298	0.590	0.577	0.576
EU	Processed ruminant	-0.194	-0.193	-0.193	-0.215	-0.211	-0.211
Brazil	Processed ruminant	0.174	0.161	0.159	0.200	0.166	0.162
R.S. America	Processed ruminant	0.217	0.219	0.219	0.156	0.159	0.160
EU	Processed non-ruminant	-0.624	-0.624	-0.624	-0.794	-0.794	-0.794
Brazil	Processed non-ruminant	1.282	1.281	1.281	1.715	1.712	1.712
R.S. America	Processed non-ruminant	4.359	4.360	4.360	5.455	5.457	5.457
EU	Beverage and sugar	-0.231	-0.231	-0.231	-1.041	-1.041	-1.041
Brazil	Beverage and sugar	1.612	1.619	1.620	5.215	5.251	5.255
R.S. America	Beverage and sugar	0.741	0.741	0.741	3.908	3.907	3.907
EU	Sugarcane Ethanol	-0.157	-0.155	-0.155	-0.403	-0.402	-0.402
Brazil	Sugarcane Ethanol	0.190	0.201	0.202	-0.004	0.015	0.018
R.S. America	Sugarcane Ethanol	-0.128	-0.126	-0.125	-0.850	-0.845	-0.844
EU	Processed dairy	0.048	0.048	0.048	0.033	0.033	0.033
Brazil	Processed dairy	-0.187	-0.191	-0.191	-0.194	-0.202	-0.203
R.S. America	Processed dairy	-0.453	-0.452	-0.452	-0.499	-0.496	-0.496
EU	Affected industries and services	0.042	0.042	0.042	0.060	0.060	0.060
Brazil	Affected industries and services	-0.190	-0.191	-0.192	-0.307	-0.311	-0.312
R.S. America	Affected industries and services	-0.196	-0.196	-0.196	-0.313	-0.313	-0.313

Land use impacts

Table 1-4 shows the impacts of the EMTA on the harvested area aggregated into four main crop categories: Soybeans, other oilseeds, sugar crops, and other crops. This table shows that:

- In general, global harvested area increases, from 192 thousand hectares in the S11 scenario to 396.3 thousand hectares in the S23 scenario.
- The expansion in the harvested area of Brazil varies from 210 thousand hectares in the first scenario to 417 thousand hectares in the last one.
- The expansion in the harvested area of R. S. America varies from 8.7 thousand hectares in the first scenario to 18.4 thousand hectares in the last one.
- The higher the trade elasticity, the more expansion in harvested area.

- The less effective land governance in Brazil, the more expansion in harvested area in this country.
- Harvested area of soybeans increases in Brazil and R. S. America.
- Harvested area of sugarcane also grows in Brazil and R. S. America.
- Harvested area goes down in the EU and the region represents other countries.

Table 1-4. Impacts of the EMTA on harvested area (Hectares).

Scenarios	Crops	EU	Brazil	R. S. America	Others	Total
S11	Soybeans	-5,238	54,642	46,358	-40,740	55,023
	Other oilseeds	-16,481	868	-8,359	-18,309	-42,281
	Sugar crops	-1,497	109,884	4,489	-1,766	111,110
	Other crops	8,319	44,976	-33,782	48,656	68,170
	Total	**-14,896**	**210,369**	**8,707**	**-12,158**	**192,022**
S12	Soybeans	-5,274	64,070	45,632	-43,985	60,444
	Other oilseeds	-17,423	1,108	-8,483	-20,831	-45,628
	Sugar crops	-1,484	109,452	4,515	-1,634	110,850
	Other crops	8,682	51,999	-33,293	49,431	76,818
	Total	**-15,498**	**226,629**	**8,372**	**-17,018**	**202,484**
S13	Soybeans	-5,277	64,812	45,560	-44,316	60,779
	Other oilseeds	-17,520	1,122	-8,496	-21,090	-45,983
	Sugar crops	-1,483	109,359	4,518	-1,621	110,774
	Other crops	8,717	52,319	-33,245	49,434	77,225
	Total	**-15,563**	**227,612**	**8,338**	**-17,592**	**202,795**
S21	Soybeans	-41,416	8,042	96,726	-58,107	5,245
	Other oilseeds	-1,169	-604	-15,795	-1,343	-18,911
	Sugar crops	-8,721	336,912	27,756	-7,032	348,915
	Other crops	29,974	37,260	-89,445	60,745	38,534
	Total	**-21,332**	**381,610**	**19,242**	**-5,737**	**373,783**
S22	Soybeans	-41,621	30,684	94,588	-67,529	16,122
	Other oilseeds	-2,948	-248	-15,968	-6,196	-25,360
	Sugar crops	-8,702	337,078	27,813	-6,902	349,287
	Other crops	30,775	47,204	-87,904	65,209	55,284
	Total	**-22,496**	**414,718**	**18,529**	**-15,418**	**395,333**
S23	Soybeans	-41,643	32,676	94,362	-68,518	16,878
	Other oilseeds	-3,133	-228	-15,987	-6,664	-26,012
	Sugar crops	-8,700	337,027	27,819	-6,889	349,256
	Other crops	30,861	47,562	-87,745	65,555	56,232
	Total	**-22,614**	**417,037**	**18,448**	**-16,517**	**396,354**

Table 1-5 shows the impact of EMTA on the land cover item. From this table, we can conclude that:

- Global area of cropland increases, from 43.8 thousand hectares in the S11 scenario to 274.5 thousand hectares in the S23 scenario.
- Global area of pastureland changes from an increase of 65.6 thousand hectares in the S11 scenario to a reduction by 31.5 thousand hectares in the S23 scenario. In the case of S23, less effective land governance in Brazil leads to more expansion in cropland and more production of feed crops. This encourages the livestock industry in Brazil to keep using its cropland pasture[7], give up some pastureland, and use more feed crops in its production process.
- Global forest area decreases, from 43.8 thousand hectares in the S11 scenario to the 274.5 thousand hectares in the S23 scenario.
- The expansion of the cropland area of Brazil varies from 42.8 thousand hectares in the first scenario to 266.9 thousand hectares in the last one.
- The expansion of the cropland area of R. S. America varies from 7.9 thousand hectares in the first scenario to 17 thousand hectares in the last one.
- The higher the trade elasticity, the more expansion in cropland area.
- The less effective land governance in Brazil, the more expansion in cropland in this country.
- The higher the trade elasticity, the more deforestation.
- The less effective land governance in Brazil, the more deforestation in cropland in this country.
- Finally, the changes in harvested area and cropland area per region may not be identical due to multiple cropping and/or changes in idled land.

[7] Cropland pasture represents cropland which has not been cultivated and used by the livestock sector as pastureland.

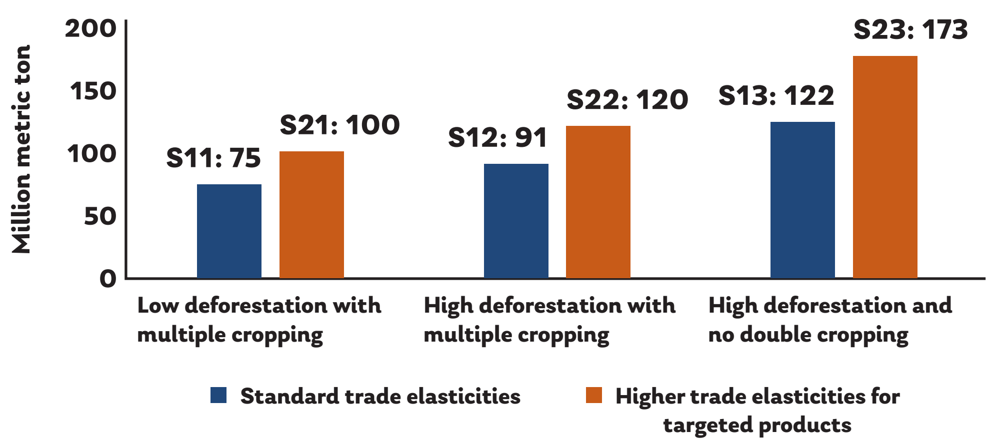
Table 1-5. Impacts of the EMTA on the land cover item by region (Hectares).

Scenarios	Land Types	EU	Brazil	R. S. America	Others	Total
S11	Forest	3,120	-55,728	-66,504	9,680	-109,432
	Pasture	-148	12,928	58,592	-5,760	65,612
	Cropland	-2,972	42,800	7,912	-3,920	43,820
S12	Forest	3,184	-78,352	-66,712	10,304	-131,576
	Pasture	-80	14,192	59,136	-4,960	68,288
	Cropland	-3,104	64,160	7,576	-5,344	63,288
S13	Forest	3,184	-110,752	-66,752	10,368	-163,952
	Pasture	-68	-35,056	59,216	-4,944	19,148
	Cropland	-3,116	145,808	7,536	-5,424	144,804
S21	Forest	5,424	-83,584	-86,840	10,928	-154,072
	Pasture	-1,164	6,192	69,056	-9,360	64,724
	Cropland	-4,260	77,392	17,784	-1,568	89,348
S22	Forest	5,520	-112,544	-87,456	11,936	-182,544
	Pasture	-1,052	-4,416	70,352	-7,360	57,524
	Cropland	-4,468	116,960	17,104	-4,576	125,020
S23	Forest	5,552	-172,960	-87,552	11,984	-242,976
	Pasture	-1,032	-93,920	70,496	-7,088	-31,544
	Cropland	-4,520	266,880	17,056	-4,896	274,520

Land use emission impacts

Finally, to evaluate the magnitude of the land-use emissions for each scenario, we use the AEZ-EF model (Plevin et al. 2004). The results are presented in Figure 1-9. As shown in this figure, the land emissions vary from 75 million metric tons of CO_2^e from the first scenario (S11) to 173 million metric tons in the last scenario (S23). Note that one can mix the land-use changes obtained from the GTAP-BIO model with other emission models as well.

Figure 1-9. Land-use emissions for examined scenarios.



CONCLUSION

The chapter examined the economic and land use impacts of the EU-Mercosur trade agreement using a well-known computable General Equilibrium model, GTAP-BIO. Results show that this trade agreement could generate major welfare gains for the EU region and also for Brazil and the Rest of South America. Some countries will suffer from this trade agreement. However, global welfare is positive. Regarding land use, the impacts are small if Brazil effectively governs land-use changes to control deforestation (See in Chapter 3 if Brazil is governing deforestation). Otherwise, the land-use impacts grow significantly leading to more land-use emissions.

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APPENDIX I.
ESTIMATIONS IN EUROS

Table A1. Welfare impacts (EV) of the EU-Mercosur trade agreement (Million Euros).

Region	S11	S12	S13	S21	S22	S23
EU	1,480	1,485	1,485	1,549	1,556	1,557
Brazil	525	515	514	548	531	529
R. S. America	187	184	184	223	215	215
US	-389	-392	-392	-397	-404	-404
China	-605	-595	-595	-723	-705	-704
Other	-892	-888	-887	-973	-965	-964
Total	**307**	**308**	**308**	**226**	**229**	**229**

Figure A1. EU imports of soybeans by exporting region for all examined scenarios (Million Euros).

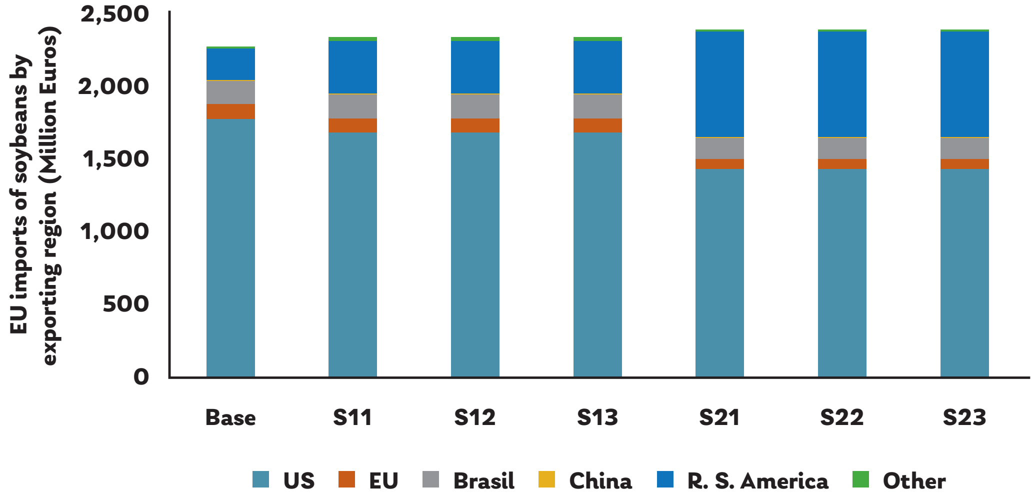


Figure A2. EU imports of beef by exporting region for all examined scenarios (Million Euros).

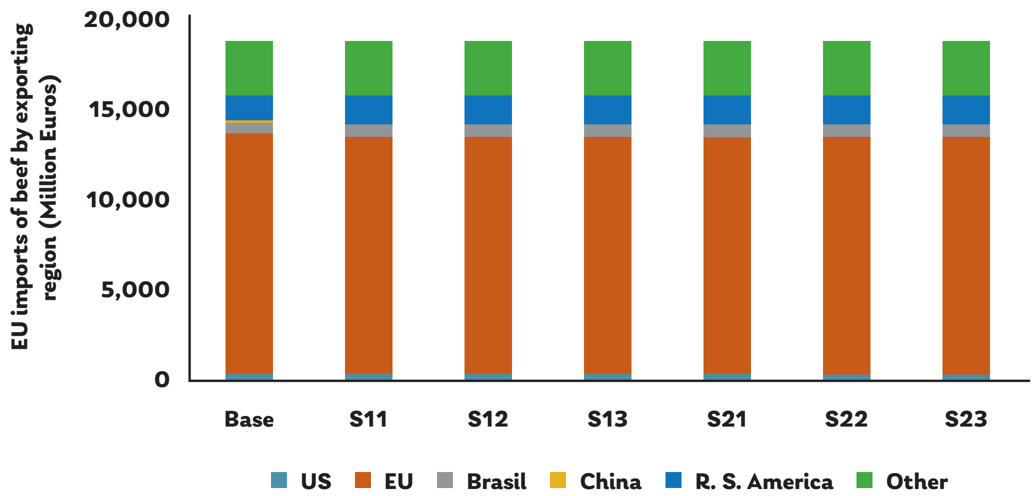


Figure A3. EU imports of pork and poultry by exporting region for all examined scenarios (Million Euros).

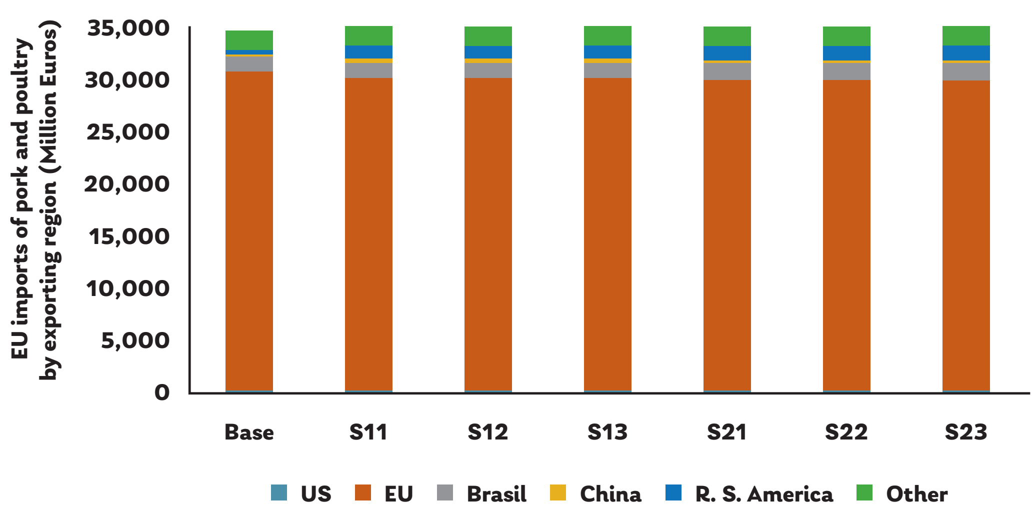


Figure A4. EU imports of beverages and sugar from exporting regions for all examined scenarios (Million Euros).

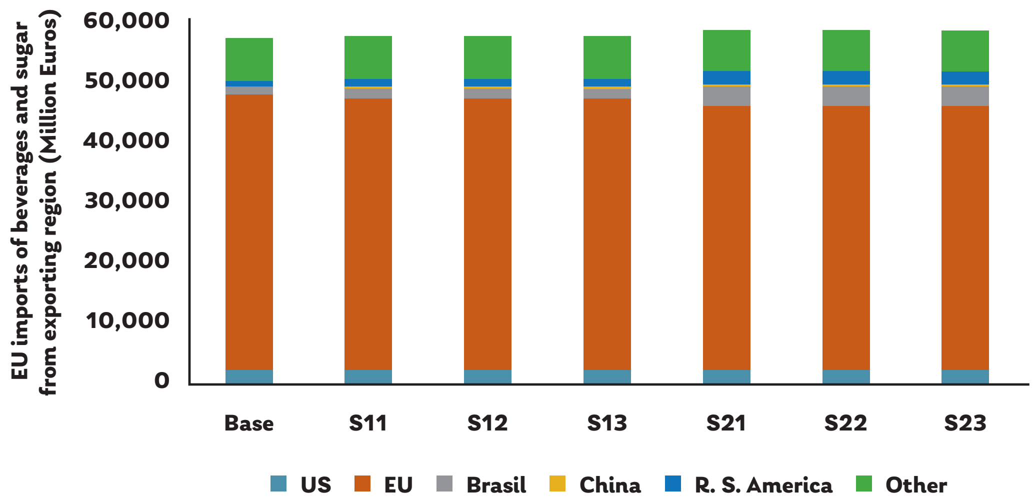


Figure A5. EU imports of beverages and sugar from Mercosur (Million Euros).

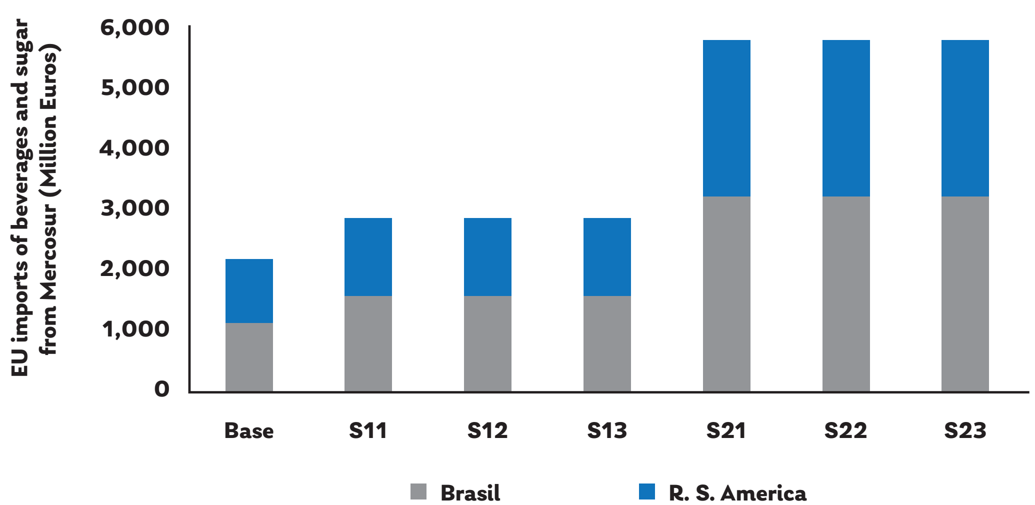


Figure A6. Mercosur imports of processed dairy from the EU (Million Euros).

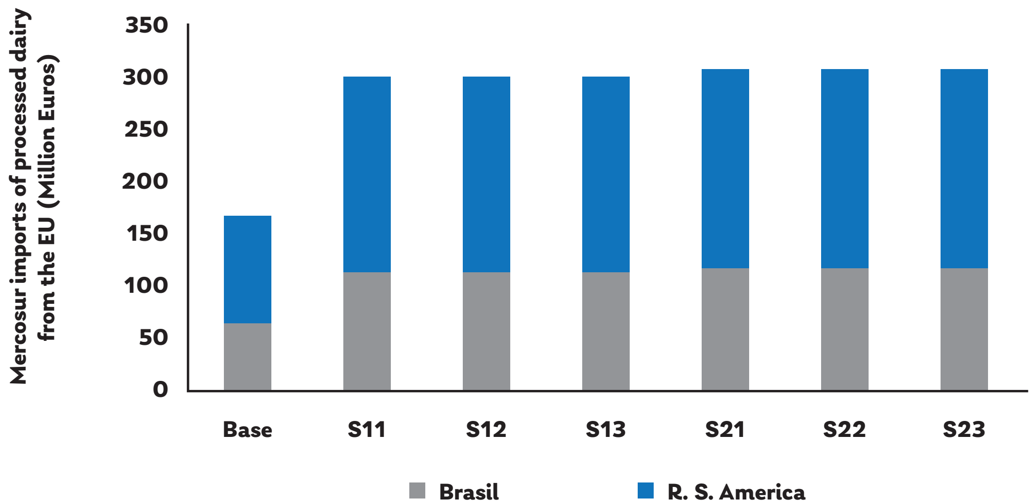
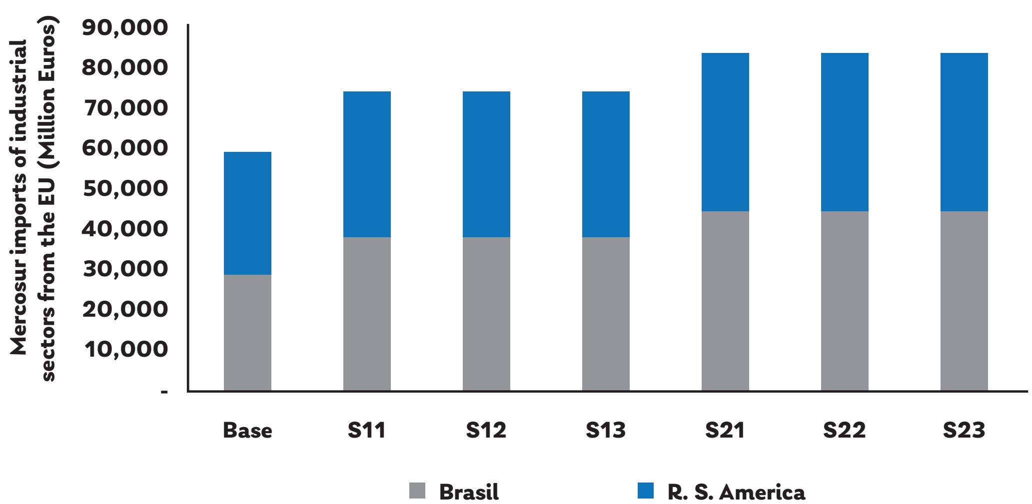


Figure A7. Mercosur imports of industrial sectors from the EU (Million Euros).



Chapter 2.

The EU-Mercosur trade agreement: where is the greatest risk of deforestation in Brazil?

Eugenio Arima[1] & Paulo Barreto [2]

[1] Eugenio Arima is an associate professor in the Department of Geography and the Environment at the University of Texas at Austin.
[2] Paulo Barreto is an associate researcher at IMAZON (Amazon Institute of the People and The Environment) a not for profit institute in Belém, Brazil.

INTRODUCTION

The previous chapter shows that the EU-Mercosur trade agreement (EMTA) would lead to additional deforestation in the Mercosur countries and that, on average, most deforestation would be in Brazil. This chapter analyzes where the deforestation is likely to occur in the Cerrado and Amazon biomes, which concentrated 96,7% of total deforestation in Brazil in 2019. Sixty percent happened in the Amazon and 33.5% in the Cerrado (Mapbiomas 2020).

We used two steps to project the location of future deforestation (see details in Appendix I). First, we estimated the probability of a given area to be ever deforested (spatial Bayesian probit model - Smith and LeSage 2004, Arima 2016. Specifically, we assessed the significance of factors potentially associated with deforestation from 2001 to 2018, including:

- Euclidean distance to unpaved roads. A subset of unpaved roads was created by removing the roads with attributes 'pavimentada - paved', 'duplicada – duplicate', 'planejada - planned', and 'travessia - crossing'. The remaining segments correspond to unpaved roads. Source: MMA – Ministry of Environment.
- Euclidean distance to paved roads, also from the same dataset, selected segments with attributes 'pavimentada - paved' or 'duplicada - duplicate'. Source: MMA.
- Euclidean distance to the previous deforestation up to the base year of 2000. Source: Mapbiomas.
- Annual mean precipitation calculated using TRMM data from 1999-2018 using simple raster algebra. Source: NASA.
- Indigenous lands included all demarcated lands but not 'em estudo – under analysis' or 'planejamento - planning'. Source: MMA.
- Conservation units at state and federal levels, integral protection. Source: MMA.
- Federal conservation units under the category of sustainable use. Source: MMA.
- Soil types: moderate restrictions to agriculture (category 2), severe restrictions (category 3), and the omitted variable is very severe restrictions. Source: FAO.

Agrarian reform settlement projects included polygons with attributes 'projeto de assentamento – settlement projects', 'projeto integrado de colonização – integrated settlement project', and 'projeto agroextrativista – agroextractive project'. Source: INCRA – National Institute for Agrarian Settlement and Land Reform.

We used the deforestation data from MapBiomas (2020) collection 4.1 for both the Cerrado and Amazonia. MapBiomas maps annual land cover and land use in Brazil using Landsat imagery at 30 m resolution (the size of each image pixel). Although MapBiomas dataset began in 1985, we used 2001 to allow for potential comparisons with other datasets such as Global Forest Watch and INPE's PRODES, both of which map annual deforestation from 2001 onwards.

The second step was to allocate the projected deforestation from Chapter 1 (the GTAP model) along the existing forest landscape (post-2018). This phase consisted of i- ordering the remaining (post-2018) forested pixels from highest to lowest deforestation probabilities and ii- selecting the top pixels until the sum of the area of those pixels reached the total potential deforested area predicted by the GTAP model. We will show the worst-case scenario where all 2,430 km^2 (243,000 hectares) of deforestation estimated by the GTAP model would occur in each biome. Although all the projected deforestation would not happen within Brazil and or within a single biome, the maps are useful to highlight the regions under the highest threat of deforestation that would require more mitigation interventions.

RESULTS

The risk of deforestation in the Amazon biome

Our analysis shows that the deforestation probabilities in the Amazon correlates with biophysical factors, infrastructure, and policy decisions. For example, the risk of deforestation is lower in areas with high rainfall, even when controlling for the other factors, a result consistent with previous work (Schneider et al. 2000, Chomitz and Thomas 2003). Forests on soils of the class “severe constraints to agriculture” were significantly less likely to be deforested than areas on other types of soils.

Landholders were significantly more likely to deforest areas closer to roads (unpaved and paved) than on sites far from roads. Moreover, deforestation probability is much higher within settlement projects, a finding consistent with the literature (Alencar et al. 2016, Brandão Jr. and Souza Jr. 2006). It is relevant to note that most deforestation occurs outside such areas because large landholders own most of the occupied land. Nevertheless, the fact that government-sponsored land reform projects have relatively higher rates of deforestation per unit of land deserves attention when considering mitigation options (See Box 2-1 and the next chapter).

We found that the risk of additional deforestation related to the EMTA would be distributed along several regions of the Brazilian Amazon (Figure 2-1). The red dots show where deforestation is more likely to occur: Pará (39.9%), Rondônia (32.6%), and Mato Grosso (25.2%). The remaining areas of predicted deforestation are in Amazonas and Maranhão. In Pará, well-known regions of high deforestation such as the South and Southeast of Pará, sites in Terra do Meio, and along BR-163. Northern Mato Grosso is another hot spot for deforestation. In Rondônia, the region around the capital Porto Velho and in the tri-border area (Amazonas, Mato Grosso, and Rondônia) are also hotspots of deforestation. A few isolated points worth mentioning include the new deforestation frontier in southern Amazonas state east of Humaitá along the Transamazon road.

We found that the EMTA would add the risk of deforestation in the vicinity of Indigenous lands and conservation units (Figure 2-2 and the list of specific areas in Appendix II). Deforestation has been increasing rapidly in

these areas, a likely consequence of reduced law enforcement operations and prospects for exploiting those areas for commercial purposes. The next chapter will show that such attitudes by the Brazilian government are violations of what has been agreed by the EMTA and challenges the Sustainability Impact Assessment recommendations (LSE Consulting 2020).

BOX 2-1.

DEFORESTATION WITHIN LAND REFORM PROJECTS

A combination of factors may explain the relatively higher deforestation rates in land reform projects. In the mid-2000s, the federal government improved enforcement focused on large deforestation polygons which were located in large landholdings. To be more efficient, the law enforcement agency focused on fewer large areas than in many small deforestation polygons. Additionally, smallholders in general and especially in land reform projects may have higher incentives to deforest because they can access rural public credit with lower interest rates than larger landholders. Moreover, large cattle ranchers leased or bought land[3] cleared within land reform projects to take advantage of these financial benefits and evade law enforcement (Pereira, 2012 and see extensive review in Carrero et al. 2020).

As a result of such trends, deforestation within land reform settlements increased as the percentage of the total: 11.3% of the total up to 2003 (Pacheco 2009), 24% from 2004 to 2008, and 30% from 2010 to 2014 (Alencar et al. 2016, Yanai et al. 2016). The relative growth of deforestation in land reform settlement indicates the risk of leakage when environmental policies are applied differently in the territory.

[3] Selling and renting land reform plots is illegal, which led the Federal Prosecutors Office to sue (the federal institute responsible for land reform and settlement - Barcelos & Barros 2016).

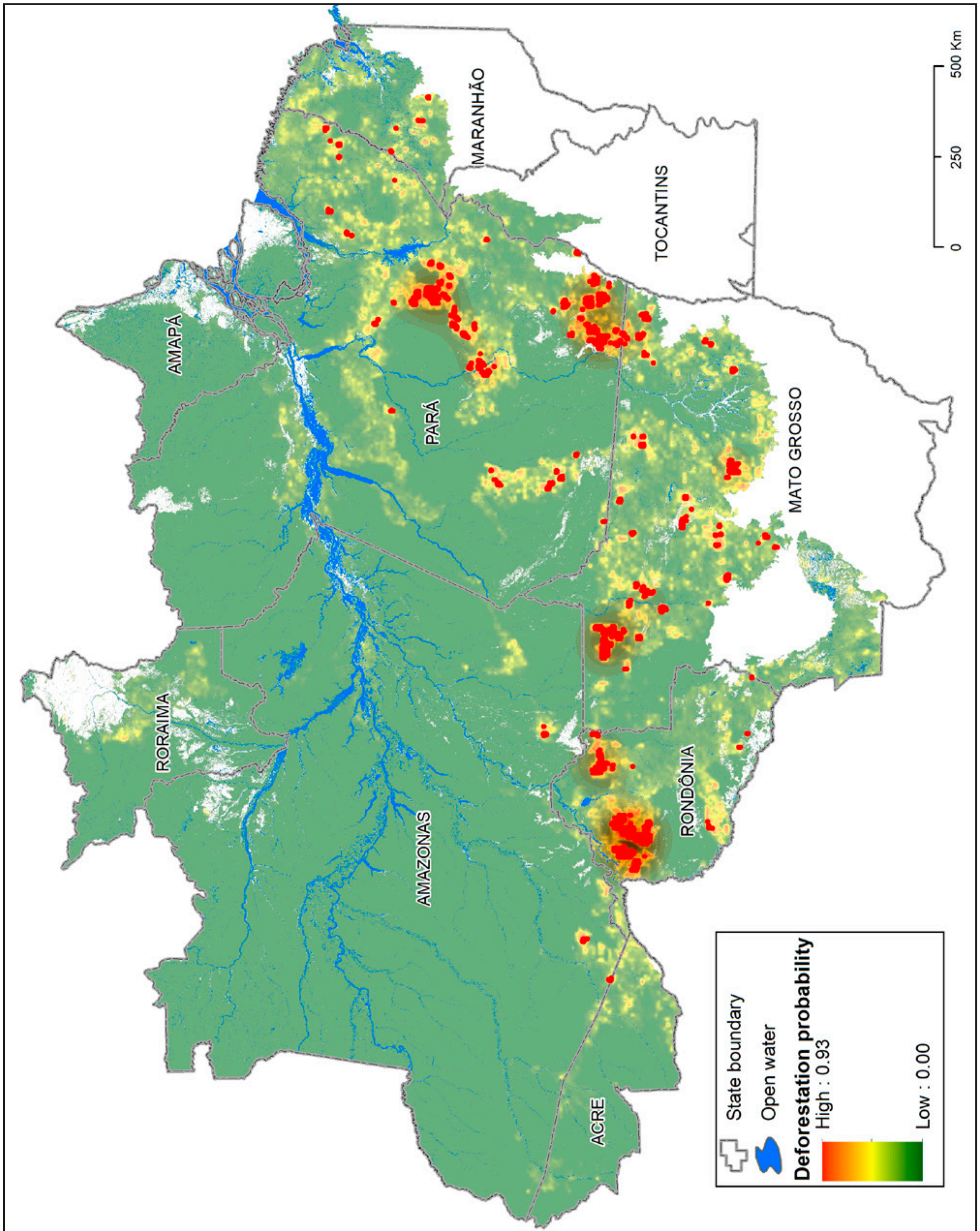
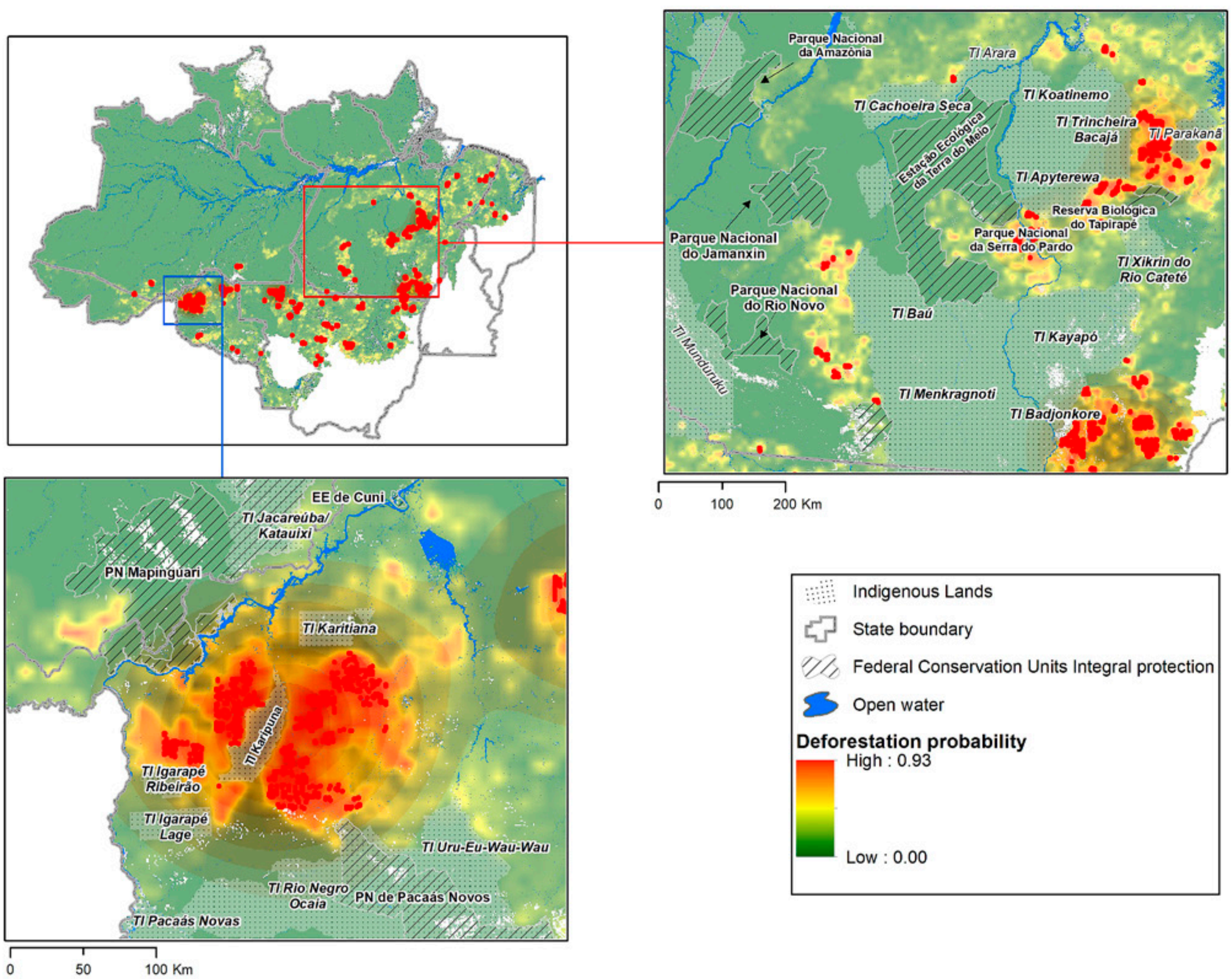


Figure 2-1. Hotspots of predicted deforestation in the Amazonia biome.

Figure 2-2. Indigenous lands and conservation units near hotspots of deforestation.



The risk of deforestation in the Cerrado biome

Overall, we found similar factors affecting the probabilities of deforestation in the Cerrado. Deforestation probabilities are higher in areas closer to roads and inside agrarian reform projects. The likelihood of deforestation was lower in protected areas. However, unlike the Amazon, regions with higher rainfall in the Cerrado are associated with more deforestation. This result is expected because rainfall is much lower in the Cerrado than in the Amazon.

The model predicts that most of the deforestation would be concentrated in the northeastern Cerrado region or MATOPIBA (an acronym for the states of Maranhão, Tocantins, Piauí, and Bahia). Maranhão is predicted to house 31.6% of the total deforestation, followed by Piauí (21.3%), and Bahia (20.4%). Mato Grosso and Tocantins would accommodate 16.4% and 5.2% of the deforestation respectively. The deforestation risk in the Cerrados of Pará, Rondônia, Minas Gerais, Mato Grosso do Sul, and Goiás would likely be small either because there is not much native Cerrado left or because the biome overlaps with those states only slightly. (Figure 2-3).

We also predict that the EMTA would increase the risk of deforestation alongside protected areas in the Cerrado. We identified two regions that are critical (Figure 2-4, See also Appendix II). The first is in Maranhão where several Indigenous reserves and one national park are next to hotspots of deforestation. The second region is in Mato Grosso, in the ecotone between the Cerrado and Amazonia, where three Indigenous reserves are close to the deforestation frontier.

Figure 2-3. Hotspots of predicted deforestation in the Cerrado biome.

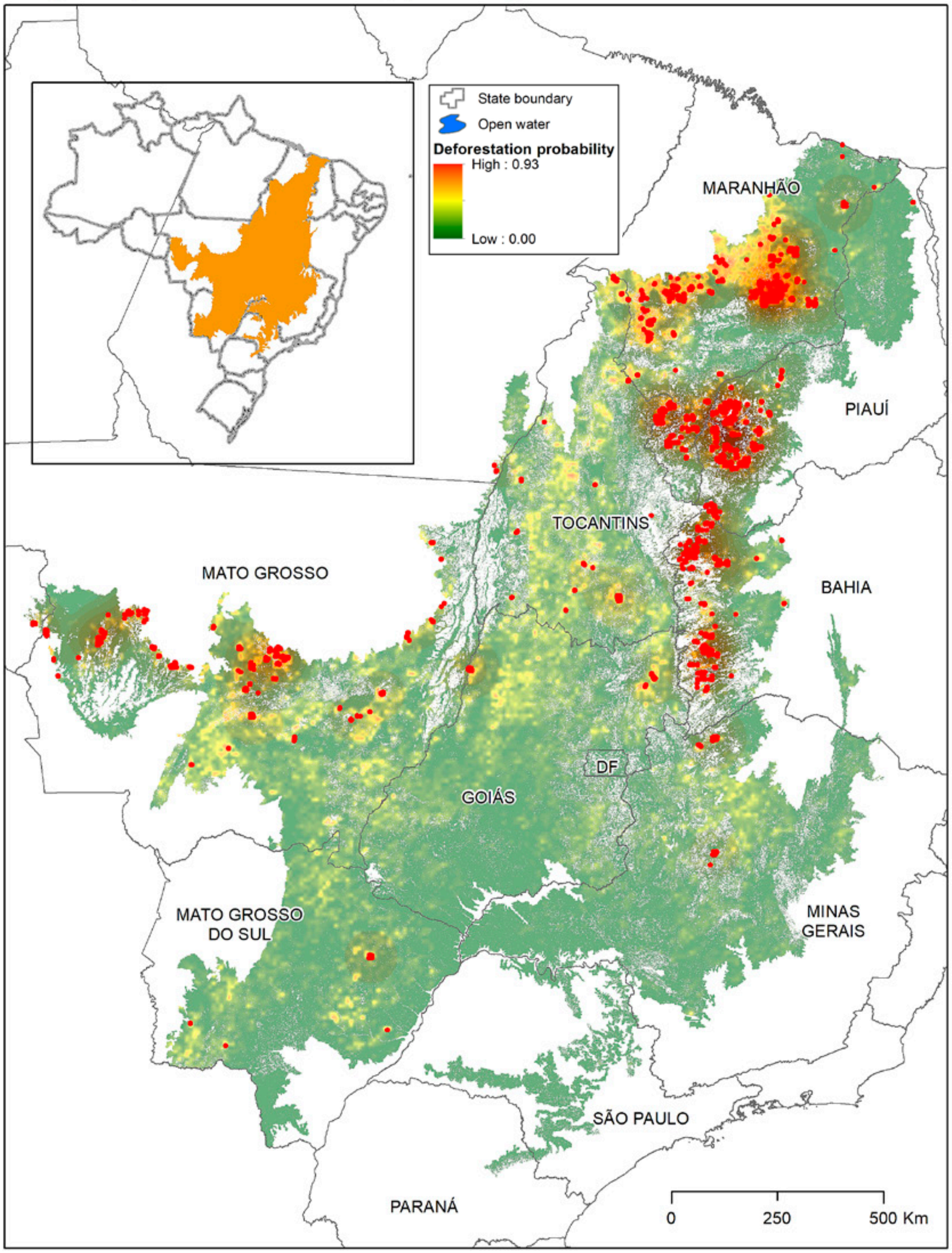
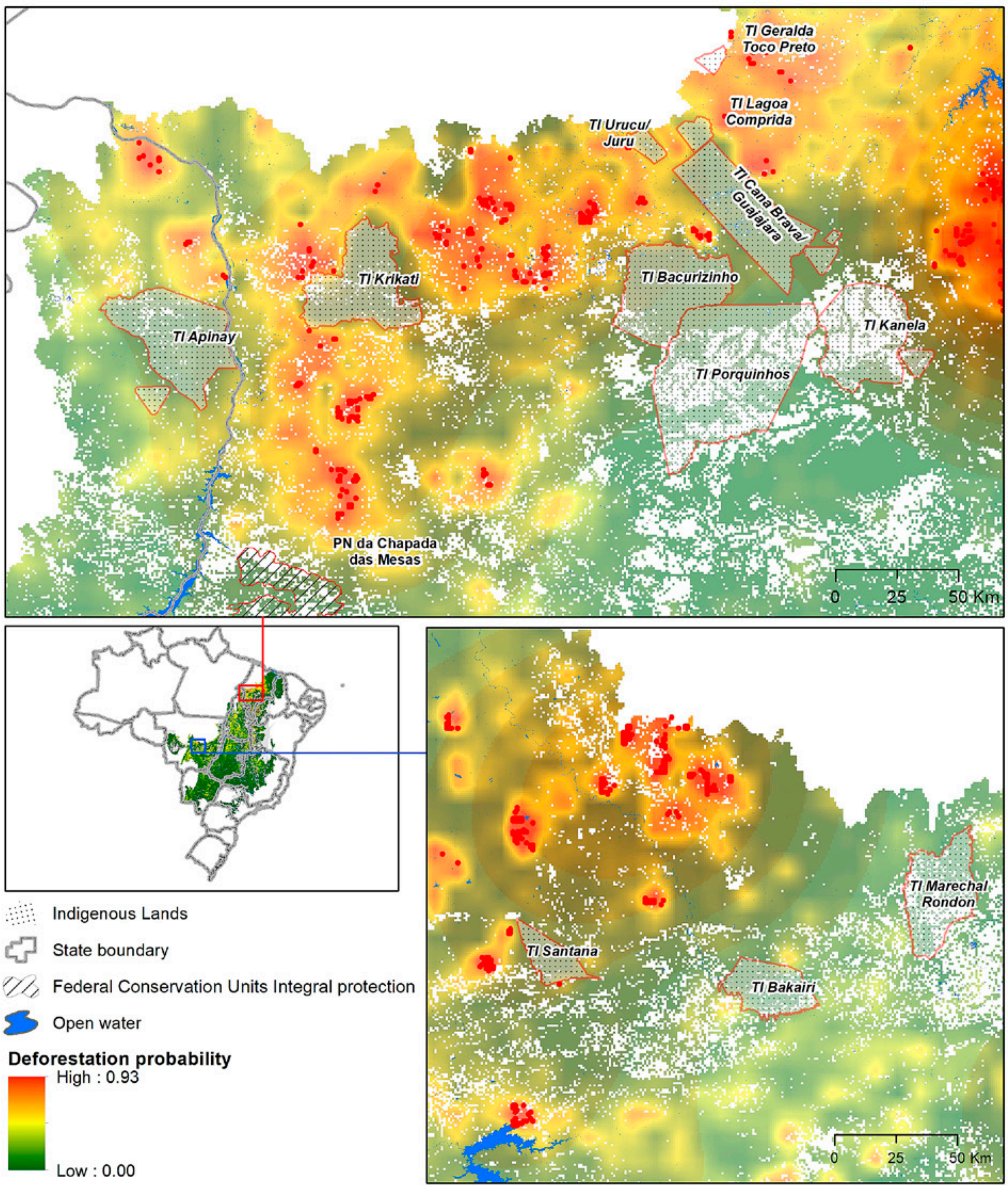


Figure 2-4. Indigenous lands and conservation units near hotspots of deforestation.



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APPENDIX I.
METHODS

The spatial allocation model is based on deforestation probability estimates resulting from a spatial Bayesian probit model (Smith and LeSage 2004, Arima 2016). In this model, deforestation (y) in cell i belonging to a region j is represented as a binary outcome (1 = deforested, 0 = otherwise):

$$y_{ij} = \begin{cases} 0, \text{ if } y^*_{ij} < 0 \\ 1, \text{ if } y^*_{ij} > 0 \end{cases}$$

where $y^*_{ij} = \mathbf{x}_{ij}\boldsymbol{\beta} + \theta_j + e_{ij}$ and $\theta_j = \rho \sum_{k=1}^{m} w_{jk}\theta_k + \mu_j$. The vector $\mathbf{x}_{ij}$ contains the explanatory variables, $\boldsymbol{\beta}$ is the vector of parameters to be estimated; θ_j is the spatial effect on region j stemming from neighboring regions, k; w is a spatial weights matrix, and ρ is the spatial autocorrelation parameter, also to be estimated. The idiosyncratic error e_{ij} is assumed to be normally distributed, conditional on θ; μ_j is also assumed to be normally distributed (for a formal description of the model, see Supporting Information document in Arima 2016 and Smith and LeSage 2004).

The dependent variable is the accumulated deforestation between 2001 and 2018, according to the mapping conducted by the project MapBiomas (2020) collection 4.1 for both the Cerrado and Amazonia. Therefore, the model estimates the probability of a given cell of *ever* being deforested, regardless of whether we may observe forest regrowth in subsequent years (Laue and Arima 2016).[4] MapBiomas maps annual land cover and land use in Brazil using Landsat imagery at 30 m resolution. Although MapBiomas dataset goes back to 1985, we decided to keep 2001 as the starting point of our analysis to allow for potential future comparative assessments with other datasets such as Global Forest Watch and INPE's PRODES, both of which map deforestation from 2001 onwards. In our analysis, we masked out water and non-forested vegetation cells identified by MapBiomas at any given year.

[4] It is not the objective of the study to model the full dynamics of land change transitions. Once an area is deforested, it may take more than a century for the original biodiversity to recover, although carbon content can be restored within a few decades.

The vector x of explanatory variables includes the relevant proximate drivers of deforestation frequently cited in the literature (with the corresponding source):

- Euclidean distance to unpaved roads. A subset of unpaved roads was created by removing the roads with attributes ‘pavimentada’, ‘duplicada’, ‘planejada’, and ‘travessia’. The remaining segments correspond to unpaved roads. Source: MMA.
- Euclidean distance to paved roads, also from the same dataset, selected segments with attributes ‘pavimentada’ or ‘duplicada’. Source: MMA.
- Euclidean distance to the previous deforestation up to the base year of 2000. Source: Mapbiomas.
- Annual mean precipitation calculated using TRMM data from 1999-2018 using simple raster algebra. Source: NASA.
- Indigenous lands included all demarcated lands but not ‘em estudo’ or ‘planejamento’. Source: MMA.
- Conservation units at state and federal levels, integral protection. Source: MMA.
- Federal conservation units, sustainable use. Source: MMA.
- Soil types: moderate restrictions to agriculture (category 2), severe restrictions (category 3), and very severe restrictions was the omitted variable. Source: FAO.
- Settlement projects included polygons with attributes ‘projeto de assentamento’, ‘projeto integrado de colonização’, and ‘projeto agroextrativista’. Source: INCRA.

All digital GIS files either were in or converted to a raster format, projected to Albers conic equal-area projection, and resampled to 900 m cell resolution using the nearest neighbor algorithm, yielding 4,943,201 cells for the Amazon and 2,020,568 cells for the Cerrado, which constitute the number of observations in the regressions. The nearest neighbor resampling algorithm resulted in a total deforested area that was closer to the original numbers than any other method available. This meso-scale cell resolution (900 m) was chosen as a good compromise between the various scales of data available. For example, the deforestation data is 30 m, but the vector data (GIS lines and polygons) are usually in the 1: thousand or 1: million scale. In addition,

the spatial Bayesian probit model is computationally very intensive, requiring RAM memory in excess of 32 GB and three days of processing using fast multi-processors (4 cores at 3.4 GHZ). Nonetheless, the resulting probability map can be downscaled to higher resolutions using, for example kernel algorithms due to its strong spatial dependency, i.e. neighboring cells showing similar probabilities as shown in results below.

The regional spatial autoregressive process was implemented following the methods described in Arima (2016) where contiguous cells are labelled and assigned to regions formed by 10x10 neighborhood cells, creating 26,361 regions in the Cerrado and 52,966 regions in the Amazon.

This spatial regression requires a computationally intense matrix inversion that fails if the data values are very different in scale. Therefore, the distance variables (e.g. distance to roads and deforestation), which were originally calculated in meters, were divided by 10,000. Likewise, the precipitation variable originally in mm was converted to meters. This linear transformation does not change the regression results but only the scaling of the estimated coefficient and the interpretation of their corresponding partial effects (see below in Results).

The results presented in the next section are based on the average of 500 valid draws after the first 500 were omitted for convergence during the burn-in phase of the Markov Chain Monte Carlo procedure used (Smith and LeSage 2004).

Statistical Analysis and Spatial Allocation of Deforestation - Amazon

For the Amazon biome, about 7% of the cells used in the regression were deforested (variable dft) between 2001-2018 (Table A1). The average distance to an official unpaved road (d2unp) and paved road (d2pv) was 104 km and 167 km respectively.

The average distance to a deforested area (d2dft) was only 7.7 km, possibly due to the ubiquitous presence of speckles of deforestation mapped by Mapbiomas all over the Amazon (Figure A1). Precipitation in the area (trmm) ranges from 1.19 m to 4.38 m of rain yr- with a mean precipitation of 2.34 m yr-. Indigenous lands (indg) covered roughly 23% of the area.

State integral protection conservation units covered 2.8% whereas federal integral protection units (ucfi) encompassed another 6.9% of the total area. Conservation units where sustainable use is allowed (ucfus) covered 7.3%. Soils with moderate constraints (soilmod) to agriculture were 9% of the total and 56% were classified as severely constrained (soilsev). The remaining soil type is classified as 'very severe soil constraints', the omitted category in the regression.[5] Finally, settlement projects accounted for 4.5% of the cells.

Table A1. Descriptive statistics of variables used in Amazonia regression.

Variable	Obs	Mean	Std. Dev.	Min	Max
dft	4,943,201	.07099	.25681	0	1
d2unp	4,943,201	10.44046	10.05844	0	49.30135
d2pvd	4,943,201	16.74044	13.79114	0	73.67928
d2dft	4,943,201	.76914	.81216	0	6.11072
trmm	4,943,201	2.34643	.43054	1.19364	4.38225
indg	4,943,201	.23299	.42273	0	1
ucei	4,943,201	.02792	.16476	0	1
ucfi	4,943,201	.06875	.25303	0	1
ucfus	4,943,201	.07292	.26001	0	1
soilmod	4,943,201	.09057	.28701	0	1
soilsev	4,943,201	.56360	.49593	0	1
projass	4,943,201	.04520	.20775	0	1

Note: water bodies, non-forested areas, and areas deforested prior to 2001 were masked out. Therefore, these numbers do not necessarily correspond to the statistics for the Amazon as a whole.

[5] It is not the objective of the study to model the full dynamics of land change transitions. Once an area is deforested, it may take more than a century for the original biodiversity to recover, although carbon content can be restored within a few decades.

The spatial probit model statistical results are presented in Table A2.

The distance to unpaved and paved roads had their expected negative effect whereas distance to deforestation showed the opposite hypothesized effect, i.e. the greater the distance to previously deforested areas, the higher the probability of deforestation, holding everything else constant.[6] That is to say, if one picks two cells that are equally distant from a road, say 5 km, same soil type, same level of protection, and so on. First cell is 1 km from previous deforestation while the second cell is 5 km from previous deforestation. The model suggests that the second cell will have a higher probability of deforestation. This result may be a consequence of the regional effect of the spatial model that might be picking the effect of distance to deforestation because, by definition, the spatial effect looks at the effect of neighboring cells within a 10x10 "window" around each cell.[7] Therefore, once those are controlled for, the results suggest that there is some deforestation that is occurring that is "leapfrogging" previously deforested areas. These issues do not affect our prediction of where deforestation is more likely to occur.

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[6] We first hypothesized that this unexpected result was likely due to the 'speckled' deforestation issue aforementioned (Figure A1). These small fragments of deforestation are ubiquitous in isolated areas with very low overall deforestation but nonetheless reduce the 'distance to deforestation' values. In a subsequent analysis (not shown in this report but available upon request), we removed all the speckles and kept only blocks of deforestation that were at least 10 cells in size for purposes of recalculating distance to these contiguous deforestation patches, and re-ran the regression. The results were essentially the same, which indicates that those speckles are not the likely cause of the positive effect of the variable "distance to deforestation."

[7] We ran non-spatial probit models for both the Cerrado and Amazonia datasets and found the variable distance to deforestation to be negative but distance to paved road positive (flipped effects), which might indicate that the regional effect is indeed picking up the effect of distance to deforestation.

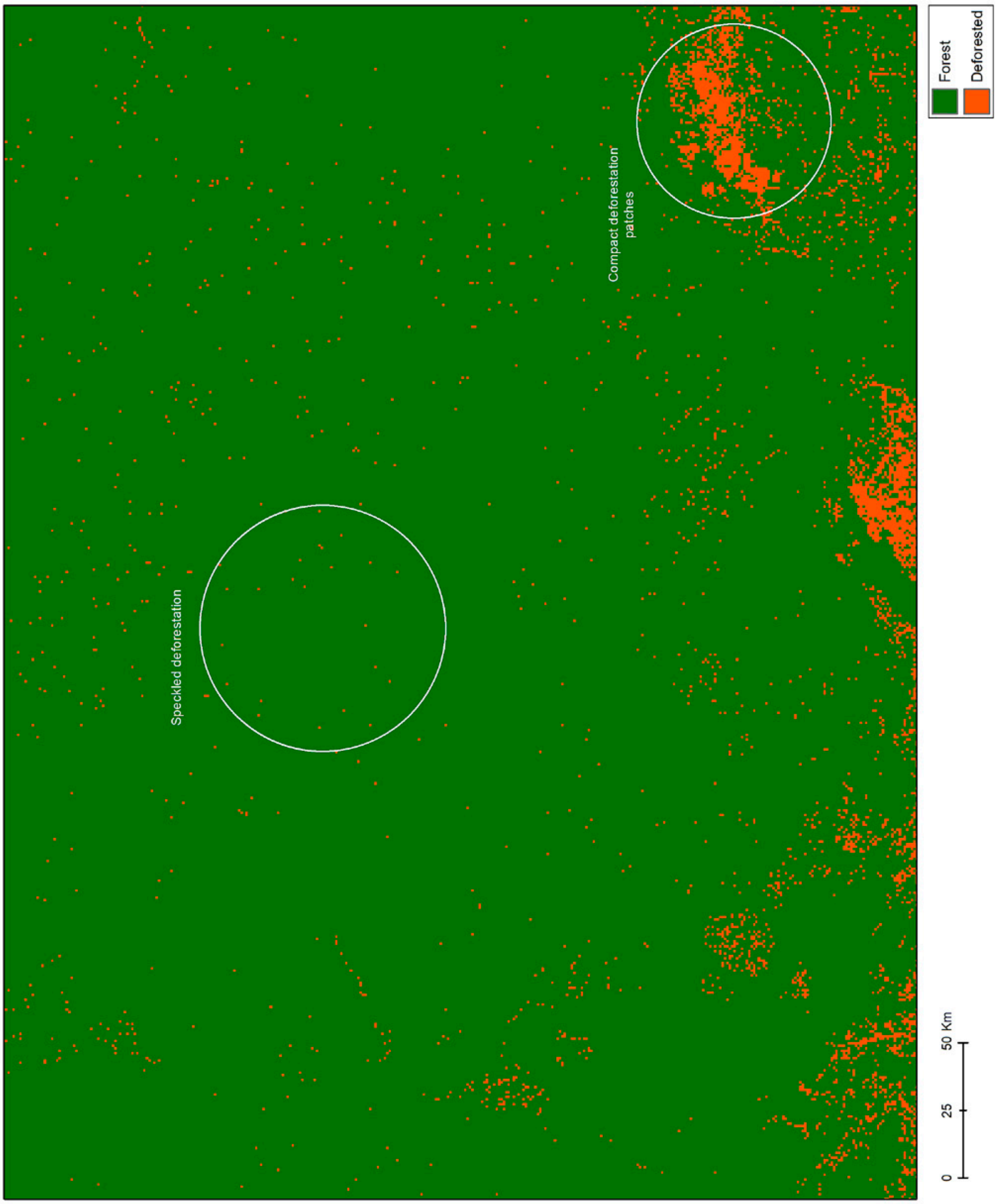


Figure A1. Example of speckled deforestation in an isolated area in northern Pará State. Source: Mapbiomas.

Table A2. Spatial Bayesian probit regression analysis results for Amazonia (n=4,943,201).

Variable	Coefficient	Std Deviation	p-value
const	0.0864	0.1758	0.382
d2unp	-0.0473	0.0034	0.000
d2pvd	-0.0118	0.0017	0.000
d2dft	0.1884	0.0369	0.000
trmm	-0.9134	0.0681	0.000
indg	-1.1580	0.0278	0.000
ucei	-1.1795	0.0323	0.000
ucfi	-1.1935	0.0179	0.000
ucfus	-0.7328	0.0171	0.000
soilmod	0.2146	0.0076	0.000
soilsev	0.1810	0.0059	0.000
projass	0.6964	0.0090	0.000

In terms of practical significance, we calculated the so-called average partial effects (APE) for a continuous variable k as $\hat{\beta}_k[N^{-1}\sum_{i=1}^{n}\phi(\mathbf{x}_i\hat{\boldsymbol{\beta}}+\hat{\theta}_J)]$, where ϕ is the standard normal density function and $\hat{\beta}_k$ is the estimated coefficient of the variable k. For a binary variable k, APE is $N^{-1}\sum_{i=1}^{n}[\Phi(\mathbf{x}_{k-,i}\hat{\boldsymbol{\beta}}_{k-}+\hat{\theta}_J+\hat{\beta}_k)-\Phi(\mathbf{x}_{k-,i}\hat{\boldsymbol{\beta}}_{k-}+\hat{\theta}_J)]$, where the index k-indicates that the variable k is not part of the vector and Φ is the cumulative normal. Unpaved roads have a much higher partial effect than paved roads, which indicates the persistent influence of paved roads even at greater distances. For example, a pixel 100 km away from an unpaved road has, on average, a probability of being deforested 0.03 smaller than a similar cell near an unpaved road. The same distance from a paved road reduces the probability by only 0.007. The reduction in probability as distance increases is much smaller when a road is paved, a fact consistent with other studies (Pfaff et al. 2004). Although small, these numbers should be interpreted relative to the overall observed deforestation in the 2001-2018 period, which was only 0.07 of the total area (see Table A1). As for precipitation, an additional 1000 mm of rain is associated with a reduction of 0.056 in probability of deforestation. Protected areas have a significant impact on the probability of deforestation.

Indigenous lands reduce the average probability of deforestation by 0.045 (more than half of the overall naïve probability of 0.07). Integral protection federal and state conservation units also have similar effects, 0.043 and 0.042 respectively. Sustainable conservation units also reduce deforestation by 0.033. On the other hand, settlement projects increase the probability of deforestation by 0.028 on average.

The predicted total deforestation area (*T*) calculated by the GTAP model was allocated as follows. First, we estimated the fitted, predicted probability of each pixel according to the spatial probit model estimates. Next, we ordered the remaining (post-2018) forested pixels from highest to lowest probabilities and selected the top *n* pixels until the sum of the area of those pixels reached the total area predicted by GTAP.

Statistical Analysis and Spatial Allocation of Deforestation - Cerrado

The analysis described above was repeated for the Cerrado biome. We included the same explanatory variables to allow for systematic comparisons with Amazonia. For the Cerrado, 8.5% of the cells were deforested between 2001-2018, a slightly higher percentage than in Amazonia (Table A3). The Cerrado is endowed with a better transportation infrastructure, which translates to lower distances to nearest unpaved and paved roads, 15 km and 22 km respectively on average. The average distance to a previously deforested pixel (pre-2001) is 2.3 km, a number that indicates not only higher levels of past deforestation (40% of biome already deforested by 2001) but also fragmentation when compared to Amazonia (i.e. speckled deforestation). The Cerrado is also drier with a mean annual precipitation of 1.487 meter of rain. This biome is less protected than the Amazon. Indigenous lands account for only 3.5% of the area, federal integral protection conservation units for 1.4%, state integral protection for a meager 0.4%, and sustainable use add another 1% to the system of protected areas. This region also contains less settlement projects that corresponds to 2% of the area. In terms of soil quality, 10% is classified as having moderate constraints to agriculture and 78% with severe limitations to agriculture related to soil fertility.[8]

[8] Although FAO classifies most of the Cerrado's soils as severely constrained for agriculture due to high acidity and poor fertility, technological innovations and the green revolution led to a boom in agriculture in the Cerrado (Bourlaug, 2002).

Table A3. Descriptive statistics of variables used in Cerrado regression.

Variable	Obs	Mean	Std. Dev.	Min	Max
dft	2,020,568	.08403	.27743	0	1
d2unp	2,020,568	1.49430	1.40142	0	12.80564
d2pvd	2,020,568	2.18979	2.34291	0	23.67
d2dft	2,020,568	.23045	.50454	0	7.74209
trmm	2,020,568	1.48752	.23434	.78460	2.07124
indg	2,020,568	.03480	.18328	0	1
ucei	2,020,568	.00369	.06067	0	1
ucfi	2,020,568	.01453	.11966	0	1
ucfus	2,020,568	.01094	.10404	0	1
soilmod	2,020,568	.10748	.30972	0	1
soilsev	2,020,568	.78174	.41306	0	1
projass	2,020,568	.02084	.14287	0	1

Note: water bodies, non-forested areas, and areas deforested prior to 2001 were masked out. Therefore, these numbers do not necessarily correspond to the statistics for the Amazon as a whole.

The spatial probit model results for the Cerrado are presented on Table A4. Just like in the Amazon, the distance to roads variables were negative whereas the distance to previous deforestation was positive. We speculate that the same reasons are at play here (see above, also footnote 4). Protected areas also prevent deforestation in the Cerrado, all protected areas variables have negative signs. Settlement projects are also associated with more deforestation. Unlike the Amazon, rainfall in the Cerrado is associated with more deforestation. This is because rainfall levels in the Cerrado are much lower than in the Amazon (Tables A1 and A3). The lower range of rainfall is similar to arid regions of the Brazilian Caatinga.

Table A4. Spatial Bayesian probit regression analysis results for Cerrado (**n**=2,020,568).

Variable	Coefficient	Std Deviation	p-level
const	-3.2153	0.1075	0.000
d2unp	-0.0948	0.0051	0.000
d2pvd	-0.0567	0.0055	0.000
d2dft	1.7215	0.1021	0.000
trmm	0.7665	0.0553	0.000
indg	-1.6314	0.0358	0.000
ucei	-1.2257	0.0789	0.000
ucfi	-3.0805	0.1663	0.000
ucfus	-0.4571	0.0480	0.000
soilmod	-0.0833	0.0154	0.000
soilsev	-0.0949	0.0138	0.000
projass	0.1634	0.0105	0.000

We applied the same formulas described in the opening of this section to calculate the average partial effects of the variables of interest. For example, an additional 100 km from an unpaved road was associated with a reduction of 0.085 in the probability of deforestation. The same distance from a paved road reduced the probability of deforestation by 0.051. An additional 1000 mm of rainfall increased deforestation by 0.069. Protected areas are also highly effective in curbing deforestation in the Cerrado. Indigenous lands reduced the probability of deforestation by 0.057. Federal and state integral protection conservation units reduced the probability by 0.059 and 0.051 respectively, and sustainable use conservation units reduced the probability by 0.031. Finally, settlement projects increased the probability by 0.016.[9]

[9] Similarly, to the Amazonian case, these probabilities must be compared to the relative naïve probability of 0.08 of deforestation for the Cerrado.

APPENDIX II.
PROTECTED ED AREAS LOCATED WITHIN FIVE KILOMETERS OF AREAS UNDER RISK OF DEFORESTATION

Biome	Year created	Category	Name	Jurisdiction
Amazon	1989	Biological Reserve	Tapirapé	Federal
Amazon	2005	Biological Reserve	Nascentes Serra do Cachimbo	Federal
Amazon	1994	Indigenous Land	Alto Rio Guamá	Federal
Amazon	2008	Indigenous Land	Apyterewa	Federal
Amazon	2004	Indigenous Land	Badjonkore	Federal
Amazon	2007	Indigenous Land	Batelão	Federal
Amazon	2009	Indigenous Land	Cachoeira Seca	Federal
Amazon	1999	Indigenous Land	Karipuna	Federal
Amazon	1989	Indigenous Land	Kayapó	Federal
Amazon	2008	Indigenous Land	Manoki	Federal
Amazon	1999	Indigenous Land	Maraiwatsede	Federal
Amazon	1989	Indigenous Land	Parakana	Federal
Amazon	1998	Indigenous Land	Trincheira Bacaja	Federal
Amazon	1999	Indigenous Land	Urubu Branco	Federal
Amazon	1988	National Forest	Bom Futuro	Federal
Amazon	1998	National Forest	Itacaiunas	Federal
Amazon	1989	National Forest	Tapirapé-Aquiri	Federal
Amazon	2006	National Forest	Jamanxim	Federal
Amazon	2006	National Park	Campos Amazônicos	Federal
Amazon	1990	State Park	Corumbiara	State
Amazon	1990	State Park	Guajará-Mirim	State
Cerrado	1981	Ecological Station	Uruçui-Una	Federal
Cerrado	2001	Ecological Station	Serra Geral do Tocantins	Federal
Cerrado	1996	Indigenous Land	Arariboia	Federal
Cerrado	2008	Indigenous Land	Bacurizinho	Federal
Cerrado	1996	Indigenous Land	Cana Brava/Guajajara	Federal
Cerrado	1998	Indigenous Land	Enawenê Nawê	Federal
Cerrado	1996	Indigenous Land	Geralda Toco Preto	Federal
Cerrado	1983	Indigenous Land	Governador	Federal
Cerrado	2008	Indigenous Land	Irantxe	Federal
Cerrado	2008	Indigenous Land	Krikati	Federal
Cerrado	1987	Indigenous Land	Nambikwara	Federal
Cerrado	1985	Indigenous Land	Pirineus de Souza	Federal
Cerrado	2006	Indigenous Land	Ponte de Pedra	Federal
Cerrado	1991	Indigenous Land	Santana	Federal
Cerrado	2001	Indigenous Land	Ubawawe	Federal
Cerrado	1996	Indigenous Land	Urucu/Juruá	Federal
Cerrado	2009	Indigenous Land	Krenrehé	Federal
Cerrado	2002	National Park	Nascentes do Rio Parnaíba	Federal
Cerrado	1989	National Park	Grande Sertão Veredas	Federal
Cerrado	2002	State Park	Água do Cuiabá	State
Cerrado	2002	Wildlife refuge	Veredas do Oeste Baiano	Federal

Chapter 3.

Will the EU-Mercosur trade agreement prevent the risks of deforestation?

Paulo Barreto[1]

[1] Paulo Barreto is an associate researcher at IMAZON (Amazon Institute of the People and The Environment) a not for profit institute in Belém, Brazil.

The fact that the trade of agricultural products increases deforestation is not new for European policymakers. A report commissioned by the European Commission estimated that in 2004, the EU27 countries consumed the equivalent to 10% of the global embodied deforestation consumption (Cuypers et al. 2013). According to the report, such deforestation was mostly imported because deforestation in the EU had been negligible. A new study shed more light on the effect of free trade on deforestation in developing countries. Abman & Lundberg (2020) found that free trade agreements involving 189 countries from 2001 to 2012 resulted in significantly more deforestation over the three years after the enactment of the agreements. The awareness about the effect of trade on deforestation has intensified the discussions around the EMTA (EU-Mercosur Trade Agreement) negotiation and ratification (e.g. Fern 2019, Harris *et al.* 2019).

"A report commissioned by the European Commission estimated that in 2004, the EU27 countries consumed the equivalent to 10% of the global embodied deforestation consumption..."

The previous chapters of this report evaluated the specific deforestation risks associated with the EMTA. They projected that deforestation would increase in the Mercosur countries, particularly in Brazil, and that it would potentially affect sensitive regions once the EMTA becomes effective. Nevertheless, the proponents of the EMTA have argued that the countries could mitigate the deforestation risk using the provisions of its Trade Sustainable Development Chapter and the recommendations provided by the Sustainability Impact Assessment. In this chapter, we assess if the EMTA provisions are enough to mitigate the risk of additional deforestation.

THE TRADE AND SUSTAINABLE DEVELOPMENT CHAPTER

The EU is required by law to promote sustainable development in its trade policy (European Commission 2020), which involves adopting the following guidelines:

- *"follow international labour and environment standards and agreements;*
- *effectively enforce their environmental and labour laws;*
- *not deviate from environmental or labour laws to encourage trade or investment, and thereby preventing a 'race to the bottom';*
- *sustainably trade natural resources, such as timber and fish;*
- *combat illegal trade in threatened and endangered species of fauna and flora;*
- *encourage trade that supports mitigation of and adaptation to climate change, and;*
- *promote practices such as corporate social responsibility."*

The EMTA chapter on Trade and Sustainable Development (TSDC) provides recommendations and rules to achieve sustainability. The implementation of the TSDC is to be based on cooperation principles, meaning that the Parties (countries) should address non-compliance by consultation processes.

PRINCIPLES AND PROVISIONS TO FOSTER SUSTAINABLE DEVELOPMENT

According to the TSDC, the Parties commit to promoting:

- *"sustainable development through cooperation and understanding of their respective labour and environmental trade-related policies and measures,* ***taking into account the different national realities, capacities, needs*** *and levels of development and respecting national policies and priorities."*

The Parties agree to use trade as a:

- *"pathway towards low greenhouse gas emissions and climate-resilient development and to* ***increasing the ability to adapt to the adverse impacts of climate change in a manner that does not threaten food production****".*

The TSDC calls for the effective implementation of the UNFCCC (United Nations Framework Convention on Climate Change) and the Paris Agreement. Therefore, the Parties should implement their Nationally Determined Contribution (NDC) as noted in the Paris Agreement (Table 3-1). The NDCs are voluntary national plans to address climate change, including emission reduction targets, policies, and measures governments aim to implement – for example, Brazilian NDC targets to zero illegal deforestation by 2030. Additionally, Brazil's National Climate Change Policy – enacted before the Paris Agreement - targeted to cut the Amazon deforestation rate by 80% in 2020 compared to the average between 1996 and 2005. That is, the deforestation rate should be no larger than 3,925 square kilometers by 2020 (Ângelo & Rittl 2019).

> "...Brazil's National Climate Change Policy – enacted before the Paris Agreement - targeted to cut the Amazon deforestation rate by 80% in 2020 compared to the average between 1996 and 2005..."

Table 3-1. Climate change targets in the Nationally Determined Contribution, as noted in the Paris Agreement.

	EU	Brazil	Argentina	Uruguay	Paraguay
Overall target	At least 40% domestic reduction in GHG emissions by 2030 compared to 1990.	37% reduction in GHG emissions by 2025 and 43% by 2030 compared to 2005.	Not exceed a net emission of 483 (unconditional) million tCO2eq by 2030; conditional measures, if jointly implemented, could reduce emissions to 369 million tCO2eq for 2030.	2 % reduction in CO2 emissions intensity per GDP unit by 2025 from 1990 level. 59% reduction in CH4 emissions intensity per GDP unit by 2025 from 1990 level. 52% reduction in N2O emissions intensity per GDP unit by 2025 from 1990 level.	10% (unconditional) to 20% (conditional) reduction in GHG emissions by 2030 relative to projected emissions.
Land Use, Land-Use Change and Forestry		12 million hectares reforested by 2030. Zero illegal deforestation by 2030. Enhance sustainable native forest management.	Develop a National Forest Monitoring System and a Safeguards Information System. National Forestry and Climate Change Action Plan. To develop conservation and use plans for forested areas to improve carbon sequestration in the Chaco and Selva Misionera Areas and increase afforestation.	(Non-binding) Avoid CO2 emissions from SOC in 45% of the grasslands area by 2030. 5% increase in the native forests area of the year 2012 (892.458 ha) by 2025. At least maintenance of 100% of forest plantations under management of the year 2015 (763.070 ha) by 2025. Avoid CO2 emissions from SOC in 30% of the grasslands area (3.000.000 ha) by 2025. 25% increase in the shade and shelter forest plantations area of the year 2012, including silvopastoral systems (97.338 ha) by 2025. Avoid CO2 emissions from SOC in 100% of the peatlands area of the year 2016 (8.366 ha) by 2025.	
Agriculture		15 million ha of degraded pasturelands restored by 2030; 5 million ha integrated cropland-livestock-forestry systems by 2030.	National Agriculture and Climate Change Action Plan (PANByCC).	38% reduction in N2O emissions intensity per kg of beef cattle measured in live weight by 2025 from 1990 level.	

Source: Adapted from LSE Consulting 2020.

The Parties agree to combat illegal logging and related trade and recognize the importance of responsible management of supply chains. Expressly, they agreed, among other things, to:

- *"**promote voluntary uptake by companies of corporate social responsibility** or responsible business practices.*
- ***provide a supportive policy framework** for the effective implementation of the guidelines as mentioned above and principles.*
- *The two sides (EU and Mercosur) will **support the dissemination and use of relevant international instruments**, such as the UN Global Compact, the UN Guiding Principles on Business and Human Rights and the OECD Guidelines for Multinational Enterprises."*

The Parties also agreed to promote sustainable investing by:

- encouraging "*trade and investment in goods and services as well as the **voluntary exchange of practices and technologies** that contribute to enhanced social and environmental conditions, including those of particular relevance for climate change mitigation and adaptation, in a manner consistent with other provisions of this agreement."*

The Parties agreed that they might work together on issues such as:

- *the impact of labour and environmental law and standards on trade and investment;*
- *the impact of trade and investment law on labour and the environment;*
- ***voluntary sustainability assurance schemes such as fair and ethical trade schemes and eco-labels** through the sharing of experience and information on such systems;*
- *corporate social responsibility, responsible business conduct, **responsible management of global supply chains and accountability**, including concerning implementation, follow-up, and dissemination of relevant international instruments;*

- *the* ***promotion of the conservation and sustainable management of forests*** *to reduce deforestation and illegal logging;*
- ***private and public initiatives contributing to the objective of halting deforestation, including those linking production and consumption through supply chains****, consistent with SDGs (Sustainable Development Goals) 12 and 15.*

According to the UNEP (United Nations Environment Program)[2], SDG 12 refers to the sustainable consumption and production, which implies "*decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles". The* SDG 15 focuses on *protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably managing forests... halting and reversing land degradation and halt biodiversity loss.*

The Parties also agreed not to lower labour or environmental standards to promote trade and attract investment. Specifically, the Parties shall:

- *"...* ***strive to improve its relevant laws and policies to ensure high and effective levels of environmental*** *and labour protections;*
- ***not waive or derogate from, or offer to waive or derogate from, its environmental*** *or labour laws to encourage trade or investment;*
- *not,* ***through a sustained or recurring course of action or inaction, fail to effectively enforce its environmental*** *or labour laws to encourage trade or investment."*

The Parties approved to adopt transparency in their trade-related policies that may affect the protection of labor and environment conditions, including the encouragement for public participation.

[2] https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies

The TSDC adopts the ***precautionary principle***, which allows countries to regulate environmental or labour issues when scientific information is uncertain, even if this affects trade. Moreover, the TSD Sub-Committee may discuss possible review of TSDC provisions, taking into account, among other things, the experience gained, policy developments in each Party, results from international agreements and views presented by stakeholders.

THE TSDC DISPUTE SETTLEMENT MECHANISMS

The TSDC adopts different dispute settlement procedures than the rest of the agreement, meaning that sustainability grievances should be solved "***through dialogue, consultation, exchange of information and cooperation***" (European Commission 2019a).

The Parties agreed to create a Subcommittee on Trade and Sustainable Development in charge of facilitating and monitoring the implementation of the TSDC, including dispute resolution issues. Senior officials of each Party or their delegates should compose the subcommittee.

If any official party considers that the other side is noncompliant, it can ask for formal government consultations. If the disagreement remains 120 days after the request for consultations, one of the Parties may request that an independent panel of experts review it and make recommendations (Box 3-1). The experts' report must be public.

The Parties should discuss appropriate measures taking into account the report and recommendations of the Panel of Experts. Within 90 days after the report publication, the Party shall inform its internal civil society advisory group (DAG) and the other Party about its decisions and course of action.

The TSD Subcommittee should monitor the follow-up of the Expert Panel's report and its recommendations. The DAG may submit observations to the TSD Subcommittee in this regard.

However, the current EMTA lacks the specifics about what type of civil society mechanism will be employed, to what extent and under what conditions it will work, and what will be the scope and responsibilities of its members.

In December 2019, the European Commission created a new position (Chief Trade Enforcement Officer – CTEO) to help EU exporters gain more

value and to strengthen the enforcement of sustainable development commitments. According to the EU Commission, the CTEO should assist in responding resolutely when trade partners try to hinder dispute resolution, such as blocking the composition of panels (European Commission 2019b). The first officer was appointed in July 2020, and therefore the effectiveness of such a position is unknown.

BOX 3-1.
THE COMPOSITION AND TASKS OF THE PANEL OF EXPERTS RESPONSIBLE FOR THE ASSESSMENT OF DISPUTES

The Trade and Sustainability Sub-Committee shall, at its first meeting after the entry into force of EMTA, provide a list of at least 15 people for the Panel of Experts. The Parties will also select at least five individuals for the list of individuals that are not nationals of either Party. They will be independent of any organization or government related to the disagreement. Out of the 15 individuals, three are to be selected to address each case. The Panel of Experts will issue an interim report to the Parties within 90 days of the establishment of the Panel, and a final report no later than 60 days after publishing the interim report. The reports should present the findings and recommendations, including the applicability of the relevant provisions. The Parties involved may comment on the Experts interim report within 45 days of its publication.

THE SUSTAINABILITY IMPACT ASSESSMENT

The EU commissioned from the London School of Economics (LSE) a Sustainability Impact Assessment (SIA) of the EMTA, including an analysis of the risk of deforestation. The LSE Consulting conducted the assessment before the actual tariff reductions were agreed. Therefore, the SIA (LSE Consulting 2020) considered two levels of tariff reduction scenarios.

LSE Consulting concluded that the countries could reduce the risk of deforestation if they adopted successful past policies. The authors cite the case of Brazil, where deforestation decreased due to improved law enforcement, the expansion of indigenous reserves, the soy moratorium (2006); the beef moratorium (2009) and condition rural credit to compliance with environmental law. Under pressure not to deforest, landholders improved land-use productivity. They argue *that deforestation would be contained as part of the Parties commitment to the Paris Agreement* (as listed on Table 3-1).

The LSE Consulting recommended the parties to adopt the following specific measures to mitigate environmental impacts:

- Brazil should improve anti-deforestation policies and law enforcement activities to detect illegal logging and expand monitoring along the supply chain.
- Brazil should renew the policy environment that resulted in decreased deforestation from 2005 to 2012 (for example, the Action Plan for Prevention and Control of Deforestation in the Legal Amazon (PPCDAm)
- Brazil should encourage private sector operators to extend the Soy Moratorium to the Cerrado and to improve the effectiveness of the Beef Moratorium by, for example, expanding monitoring to all properties in the supply chain. The government should replenish IBAMA's (the federal agency responsible for environmental enforcement) workforce and reassert its authority over inspections.
- Argentina should aim at the implementation of the proposed National Action Plan on Forests and Climate Change objectives to decrease deforestation and prevent agriculture-related forest degradation.
- Paraguay should maintain the commitment to sustainable forest management, for example, by increasing the enforcement of the Zero Deforestation Law across all regions.
- Mercosur countries should:
    - convert degraded pasturelands into sustainable agriculture to increase agricultural production while preventing the clearing and degradation of forest land.

  - aim at achieving greater harmonization of deforestation regulations and monitoring across regions to prevent deforestation leakage to areas with weaker legal protection.
  - engage in a comprehensive reassessment of fertilizers and pesticides to limit possible harmful effects on human and animal health and the local ecosystem and establish a monitoring program for pesticide residues in waterways and air.
  - design smart and democratic pricing systems to encourage more efficient use of water in agriculture and preserve natural resources and biodiversity.
  - promote cooperation in the development and transfer of green technology.
- Mercosur and the EU should complement dialogue with an assertive use of dispute settlement, more open public accountability mechanisms, and ex-post monitoring, including contributions from local stakeholders, governments and multilateral bodies. They should also strengthen the engagement of civil society participation to build trust in TSD and facilitate compliance with multilateral environmental agreements.

LSE Consulting also highlighted the need for enforcement of assurances against the potential negative impact on indigenous rights. They assessed that indigenous peoples are vulnerable to the dispossession of their lands due to the lack of clear land rights or the absence of the implementation of existing protective measures in Argentina, Brazil, and Paraguay. For example, the SIA cite the findings of the UN High Commissioner for Human Rights: the Brazilian government and private companies have used appeal courts to suspend indigenous rights in favour of other interests such as infrastructure projects. The SIA report reinforces the need for anti-deforestation policies to avoid the expansion of agriculture into indigenous lands. Specifically, the SIA report recommends that:

- Argentina should strengthen the National Institute of Indigenous Affairs to complete the Territorial Survey of Indigenous Communities to prevent post-investment land disputes.
- Brazil should consider withdrawing its proposed bill to open indigenous

lands for natural resources exploration and re-prioritize the demarcation of indigenous lands as well as providing FUNAI with adequate resources to protect lands.

- Argentina, Brazil and Paraguay should ensure the right to prior, free, and informed consent, especially among municipal governments with large indigenous populations.
- Mercosur governments should dialogue with civil society and present proposed investment projects before their approval.
- The EU should encourage European businesses to:
  - consult indigenous communities before investing to help to secure indigenous land rights and avoid land disputes associated with planned investments such as has happened in Argentina and Brazil.
  - consider human rights impacts before approval of large-scale investments, including the evaluation of non-market values intrinsic to indigenous peoples.

THE EU-MERCOSUR TRADE AGREEMENT IS WEAK ON PROVISIONS AGAINST DEFORESTATION

In this section, we provide evidence that the Trade and Sustainable Development Chapter provisions are insufficient to mitigate the increased risk of deforestation associated with the EMTA. Therefore, the current agreement does not promote sustainable development as required by the EU regulation.

The Paris Agreement is insufficient to ensure forest protection.

The proponents of the EMTA cite the commitment to implement the Paris agreement as a significant accomplishment of the negotiations. However, the EU and Mercosur climate mitigation targets are below what is necessary to hold warming well below 2°C, according to scientists at The Climate Action Tracker[3]. In Brazil's case, the pledge to zero illegal deforestation has been

[3] CAT is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement. The EU and Brazilian targets as insufficient, whereas Germany and Argentina are rated highly insufficient and critically insufficient for "holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C." Analysis available at https://climateactiontracker.org

placed in a distant future: 2030. Additionally, Brazil is failing to implement its National Climate Change Policy, which established that deforestation should be 3,925 square kilometres or less by 2020. In 2019 the Amazon deforestation was 155% higher than this target and it will be even higher in 2020 due to lax policies and increased market demand[4].

Additionally, according to a report commissioned by the French government, the EMTA does not provide the incentives or sanctions to stimulate the adoption of the Paris Agreement. For example, the EMTA does not include references to results-related payments to forest protection, as suggested by the Paris Agreements (Ambec et al. 2020).

Given that deforestation tends to increase within three years after trade agreements are approved (Abman & Lundberg 2020), an eventual increase of climate commitments by the EMTA parties in the mid-term review would be too late to mitigate the deforestation associated with the deal.

Potential to decouple agricultural production from deforestation exists but depends on public policies and credible private commitments.

The LSE Consulting argues that increased demand resulting from EMTA could be supplied by increased productivity in areas already deforested as it happened in the mid to late 2000`s in Brazil. The consultants suggest that Brazil could stimulate increased productivity by resuming the successful policies from that period. However, contrary to such proposals, the Brazilian government has been reducing law enforcement, undermining transparency, and promoting the expansion of public land occupation, including the following examples:

- The government reduced field inspections against deforestation by 35% in 2019 and again by 40% in 2020 (Muniz, Fonseca & Ribeiro 2020).

[4] The price of beef increased by 58% from 2018 to 2020 according to CEPEA: https://www.cepea.esalq.usp.br/en/brazilian-agribusiness-news/prices-for-beef-and-fed-cattle-arroba-hit-real-records-in-cepea-series.aspx

- In April 2019, the government added a step to process environmental fines (Brasil 2019), which effectively blocked the application of sanctions against violators of environmental laws[5]. In October 2020, four opposition parties have demanded the Federal Supreme Court to null the decree that created such regulation[6].
- In August 2019, the government exonerated the president of INPE (The National Institute for Space Research) after the institute released data showing increasing deforestation rates (Angelo & Rittl 2020).
- In October 2019, in an event for investors in Saudi Arabia the Brazilian President bragged that his pro-development discourse led to an increase in forest fires, a signal of policy change for the Amazon (Amaral 2019).
- In 2020, the Brazilian government alleged lack of funding to implement a court order demanding deployment of law enforcement against deforestation hotspots in the Amazon (G1 2020). This allegation contradicted the fact that the government was spending less than the allocated available budget (Fakebook.eco 2020). Additionally, Brazil has an alarming stock of environmental fines that are not collected: 9.4 billion[7] Euros which is equivalent to 21 years of the Ministry of Environment budget for 2020 (Bourscheit et al. 2019).
- The Brazilian government continues to stimulate land occupation by changing land laws in ways that benefit illegal invaders of public lands (Brito et al. 2019, Brito & Barreto 2020). The gains from land grabbing, in turn, undermines the economics of land use intensification because it becomes more profitable to occupy new land than to invest to improve land use productivity.

[5] The accused may request a conciliation hearing, which suspends the administrative process until such hearing occurs. In a year, IBAMA has held only five hearings out of a total of 7,205 scheduled and ICMBio held none according to a survey conducted by the Climate Observatory. (Valente 2020, Girardi 2020). Law enforcement experts criticized the new procedure because the former proceedings already included three opportunities for administrative appeals.
[6] The full petition is available at: https://bit.ly/31CuRJt
[7] R$ 59 billion, considering 6.25 Brazilian Real per Euro.

- The fact that the government has promised to open indigenous land for commercial activities has stimulated conflicts (Human Rights Watch 2020, CIMI 2019). The cases of "possessory invasions, illegal exploitation of resources, and property damage" increased by 134% from 2018 to 2019, respectively 109 to 256 (CIMI 2019). In February 2020 the president drafted a rule (Brasil 2020) to open indigenous territories to mining and agricultural production. In September 2020, the UN High Commissioner on Human Rights alerted "*about reports of rural violence and evictions of landless communities, as well as attacks on human rights defenders and journalists, with at least 10 killings of human rights defenders confirmed this year*" (Bachelet 2020).
- The federal and state governments have blocked initiatives to improve transparency on cattle transportation, which could help decoupling beef supply from deforestation (Barreto et al. 2017, Barreto et al. 2018). The government has not made cattle transportation data available even upon demands by federal prosecutors, meatpackers, and financial institutions.
- In September 2020, contrary to reality, the president stated in the UN General Assembly that most Amazon burning is related to small scale slash and burn agriculture practiced by indigenous peoples and mestizos (Alencar et al. 2020).[8]

As a reaction to the worsening environmental conditions and business risks, Brazilian society, several private sector leaders, and coalitions and experts have been demanding action (Observatório do Clima 2020, Brazilian Coalition 2020, Santander 2020, Batista 2020a, Batista 2020b). Several of the demands are similar to the recommendation by the SIA (Boxes 3-2 and 3-3).

Some of the private firms have pledged to adopt measures to curb deforestation and to stimulate more sustainable land use. On July 23, 2020, Marfrig the second largest beef company in Brazil promised to achieve full traceability of their suppliers in the Amazon by 2025 and in the Cerrado by 2030[9]. On September 22, 2020, JBS – the largest meatpacking company –

[8] In 2019, 7% of the Amazon fires occurred within indigenous lands, which covered 25% of the region's territory (Alencar et al. 2020).
[9] Marfrig's press release: https://www.marfrig.com.br/sustentabilidade/plano-verde

announced that it will use a blockchain platform to track the suppliers of its cattle suppliers by 2025[10]. Therefore, if the agreement is ratified by 2020 or 2021 deforestation would occur before the beef companies fully implement their pledges. Therefore, a faster government response would be necessary either by the private sector or governments.

However, the government responses to increased pressure against deforestation have been inconsistent. In February 2020 the federal government created the Amazon Council chaired by the Vice-President and the military has taken control of field environmental inspections in the region since May 2020. However, federal environmental inspectors from IBAMA have complained that the military intervention has hindered enforcement because the technical staff does not control the strategy and targets of operations. Additionally, the Brazilian President has unauthorized the environmental agents to destroy equipment used by criminal such as tractors validating the expectation of impunity (See field reports by Maisonnave, Almeira & Prestes 2020, Hashizume 2020, Savarese 2020, Sobrinho 2020, Valente 2019). Moreover, the additional step to process environmental fines created in 2019 has not been removed, which results in stalled enforcement (Girardi 2020).

Data available so far indicate that the criticisms by IBAMA staff and experts are valid. Monitoring conducted by the federal government program Deter[11] shows that deforestation and forest degradation (forest fire scars, selective forest cuts, degradation) from January to September in 2020 was 13% higher than in 2019 and 52% higher than in 2018. Deforestation alone in 2020 was 73% higher than in 2018 (Figure 3-1).

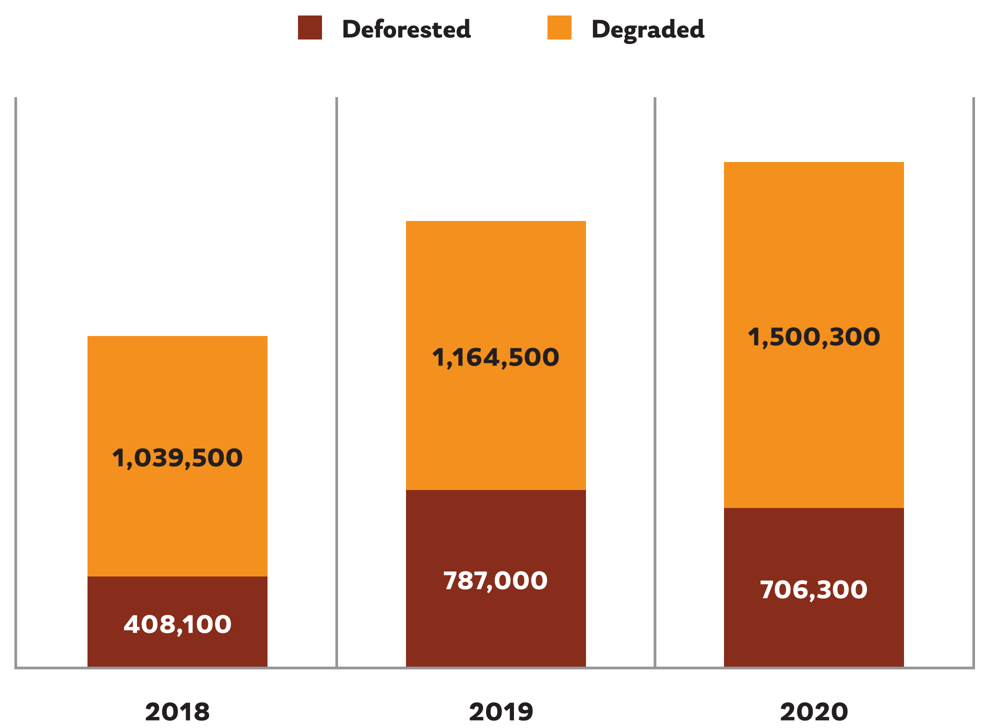
In the meantime, government officials continue using strong rhetoric against civil society actors that advocate for human rights and forest protection. For example, the president said that NGOs are a cancer that he cannot kill (Yahoo News 2020).

[10] JBS's press release: https://jbs.com.br/juntospelaamazonia/wp-content/uploads/2020/09/Release_JBS-announces-Together-for-the-Amazon_23-09.docx.pdf

[11] DETER is run by INPE - The National Spatial Research Institute - and provides daily deforestation and forest degradation alerts based on satellite imagery analysis. (http://terrabrasilis.dpi.inpe.br/app/map/alerts?hl=pt-br). DETER has been built to guide enforcement, but it is also useful to indicate land use trends. The final estimation of deforestation rate is provided by the other INPE's monitoring platform (PRODES) that is more accurate than DETER.

Moreover, the proposed 2021 federal Annual Budget Bill (Projeto de Lei Orçamentária Anual) establishes a 15% cut for civil national environmental institutions and 92% for the military environmental operations (Cardoso 2020). The government may later amend this proposal, but the current bill shows that the budget is not secured.

Figure 3-1. Hectares deforested and degraded in the Brazilian Amazon biome from January to September according to INPE's DETER program.



BOX 3-2.

THE BRAZIL COALITION ON CLIMATE AGRICULTURE AND FORESTS CALLS FOR THE REDUCTION OF DEFORESTATION

1. In September 2020 The Brazilian Coalition on Climate, Forests and Agriculture, a network of 250 representatives from agribusiness, financial sector, civil society and academia, suggested six actions to reduce deforestation (Brazilian Coalition 2020).
2. To resume and enhance surveillance, with rapid and exemplary sanction of environmental illegalities. To improve enforcement the government should support and expand the use of intelligence and expertise by IBAMA (Brazilian Institute of Environment and Renewable Natural Resources), ICMBio (Chico Mendes Institute for Biodiversity Conservation) and FUNAI (National Indian Foundation).
3. To suspend private Rural Environmental Registry (CAR, in the Portuguese acronym) located in public forest (an indication of land grabbing) and to punish illegal deforestation. To identify such violations the government should cross several data banks on land occupation.
4. To reserve 10 million hectares for protection and sustainable use. Allocate, within 90 days, 10 million hectares from the National Register of Public Forests as protected area for restricted and sustainable use in deforestation pressure hotspots.
5. To grant financing per social and environmental criteria. The National Monetary Council must require financial institutions to check environmental risks and environmental law compliance.
6. Full transparency and efficiency to vegetation clearance authorities. State and federal agencies must publicize vegetation clearing authorizations and grant access to the complete data needed to the identification of violators of environmental laws such as the CAR.
7. To suspend all land settlement processes for properties that have deforested after July 2008. To stop all land settlement processes for irregularly deforested areas after July 2008 until the areas are fully recovered. Landgrabbers commit several crimes and should not benefit by governmental land titling.

BOX 3-3.

CIVIL SOCIETY CALLS FOR THE REDUCTION OF DEFORESTATION

In August and September 2020, 62 institutions and networks of civil society organizations urged the Brazilian Government to take actions to stop deforestation (Observatório do Clima 2020). The signatories of the document included APIB network of Brazilian indigenous organizations and the Climate Observatory.

1. A five-year moratorium on deforestation in the Amazon.
2. Increased penalties for environmental crimes and deforestation, including freezing the assets of the 100 worst criminals.
3. Immediate resumption of the PPCDAm - Action Plan for Prevention and Control of Deforestation in the Legal Amazon, shelved by the Bolsonaro government.
4. Demarcation of indigenous and quilombola lands (slave descents) and the creation, regularization, and protection of Conservation Units.
5. Restructuring of federal agencies responsible for protecting the environment and indigenous rights (IBAMA, ICMBio and FUNAI).

After the release of the above five demands, APIB published a new document adding two requests:

6. Enforcement of the Forest Code (mainly the 2018 amendment to penalize illegal land production)
7. Construction of a legal framework for Supply Chain Traceability to ensure transparency and the punishment of illegal national and international companies.

The TSDC is inadequate

Several analyses have concluded that the TSDC provisions are inadequate to mitigate the environmental and social impacts of the EMTA (Harstad 2019, Echavarría et al. 2020, Harrison & Paulini 2020, Ambec et al. 2020, Kehoe et al. 2020). The EMTA approach to address non-compliance by consultation and collaboration is inadequate because it lacks sanctions and the space for civil society is limited. Additionally, the process to address complaints is lengthy (460+ days according to Echavarría et al. 2020). Moreover, it is unlikely that the voluntary encouragement for the adoption of best practices will compel change.

The use of collaboration in other cases has led to gradual improvement of environmental indicators after ratification of trade agreements where civil society was strong (Bastiaens & Postnikov 2017). However, incremental improvement of policy implementation would be insufficient to contain the surge of deforestation that in previous cases occurred within trees after trade agreements were enacted (Abman & Lundberg 2020).

According to Echavarría et al. (2020), the scope for civil society participation is limited in the current TSDC. For example, only government officials may submit to other governments officials, and governments decide whether to respond to concerns raised by DAGs. Other authors stress the limited participation of civil society in partner countries and Europe (Orbie *et al.* 2016). Defective communication between civil society and government limits the effectiveness of monitoring (Orbie et al. 2016). If civil society is unable to hold the government accountable, it will renounce from participating (Martens et al. 2018).

The expectation that Brazilian civil society would help improve the implementation of the TSDC provisions seems unrealistic under current conditions. The federal government has extinguished or severely weakened civil society participation in governance of environmental and other issues (See Box 3-4).

Additionally, voluntary initiatives are unlikely to stimulate more sustainable land uses in a context of systemic unlawfulness. The recent experience in Brazil reveals that landholders have intensified land use once the government enforced regulation, when the market boycotted products

associated with recent deforestation and due to the demand of certified timber products (Gibbs et al. 2015, Arima et al. 2014, Assunção et al. 2012).

Some argue the agreement is favorable because the EU pushes for ratification of international standards before the trade agreement is signed. However, according to Guiotto and Echaide (2019) loopholes in trade agreements allow noncompliant agents to go unpunished.

Additionally, the Brazilian government has been hostile and erratic regarding the adoption of multilateral frameworks and cooperation regarding environmental, human rights and health issues (Buarque 2020, Saraiva and Silva 2020, Castro 2020). The way Brazil is dealing with the coronavirus pandemic highlights the current government systemic impediments for cooperation and science-based decision making[12]. On October 2020, the Brazilian Ministry of Health announced that Brazil would buy vaccines co-produced by China and Brazil. However, in the next day, responding to some of his followers on social media, the Brazilian president announced that it would not buy Chinese vaccines (Poder360 2020).

The lack of transformational action by the Brazilian government combined with criticisms of the TSD chapter heightened barriers to the ratification of the EMTA in countries such as Germany, France, Netherlands, Austria, Belgium, France and Ireland. For example, in September 2019, the Austria parliament approved a motion to oblige the government to veto the ratification by the European Council (Moens 2020). In June 2020, the Dutch Parliament approved a resolution asking the government to notify the European Commission to withdraw the support to the EMTA (Ab Lago 2020). In August 2020, the German chancellor warned that environmental issues raised "considerable doubts" regarding the ratification.

In this context, in early October 2020, the European Trade Commissioner stated he will not submit the agreement for ratification by the European Council before securing additional environmental protections (MercoPress 2020, Boffey 2020). However, it is unclear how strong the so-called "pre-ratification" requirements will be. During the first two weeks of October 2020, I interviewed

[12] Saraiva and Silva (2020) summarized the consistency of inadequate cooperation by the federal government: "the president insisted on adopting positions contrary to the consensual vision in scientific circles; contrary to the World Health Organization recommendations; contrary to measures implemented by other national and subnational actors such as Congress and state and city governments; and even contrarian to sectors of his own administration".

several representatives of the European Union and member states institutions. They understood the gravity of the current situation, but several of them acknowledged the limits of the negotiation because the Brazilian government is unlikely to accept strong demands for change.

BOX 3-4.

THE BRAZILIAN GOVERNMENT HAS REDUCED CIVIL SOCIETY PARTICIPATION IN POLICY MAKING AND MONITORING

The Brazilian government has been reducing civil society participation in public governance. For example, in April 2019, the government extinguished several committees/commissions involving civil society participation on land use, sustainable development and environmental issues (Werneck 2019), including:

- The Executive Committees that dealt with deforestation prevention and control plans in the Amazon and Cerrado biomes;
- The National REDD+ Commission, which implemented actions to promote payment in exchange for de- forestation reduction results;
- The Steering Committee of the Amazon Fund (COFA), which established the guidelines for the operation of the largest Brazilian deforestation control fund (Amazon Fund);

The extinction of COFA and the weakening of other environmental policies led Norway and Germany to freeze support to the Amazon Fund.

Besides precluding civil society engagement, the Brazilian president has attacked NGOs several times. For example, he insinuated, without any evidence, that NGOs were setting fires in the Amazon to hurt his government (Verdélio 2019). Once questioned by the Supreme Court about these accusations, he replied that his statements were “mere opinion” and “just political discourse” (Vassallo and Moura 2019). In September 2020, he said on his weekly live internet feed: “*You know that NGOs, for the most part, I give no space for them. I go hard on these people there (the Amazon). I can’t kill this cancer called NGOs*”

The situation in Brazil has been noted by the UN High Commissioner for Human Rights. In September 2020 she stated: *The continued erosion of independent bodies for the consultation and participation of communities is also worrying. I call on the authorities to take strong measures to ensure that all decision-making is grounded in the contributions and needs of all people in Brazil* (Bachetet 2020).

RECOMMENDATIONS

Our analysis and review of past experiences show that deforestation would increase due to added demand combined with the formal and informal reduction of law enforcement to protect forests in recent years. Besides biological and climate losses, increased demand could harm vulnerable indigenous communities. The current proposed provision by the EMTA to mitigate such adverse effects are insufficient. Politicians and bureaucrats that pledged that the EMTA would uphold sustainability, development, and human rights principles should condition its ratification to improve performance of policies and creation of new provisions as outlined below. The focus of prevention is essential given the potential irreversible and long-term nature of land use impacts associated with the EMTA (deforestation and violent conflicts).

The following recommendations are aligned with the European Parliament resolution of September 16, 2020 on the EU's role in protecting and restoring the world's forests (European Parliament, 2020). The resolution reiterated that EU trade and investment policy should include binding and enforceable sustainable development chapters and ii- stresses that the European Union should incorporate clear commitments against deforestation in all new trade agreements including the EMTA (See Box 3-5).

1. ***Condition the ratification of the agreement to actual deforestation reduction***. The ratification or the start of EMTA tariff reductions should be contingent on Brazil reducing its deforestation according to the country's National Climate Change Policy target: 3,900 km^2. Given that Brazil will not meet its 2020 target, the EMTA should wait until such a baseline is eventually reached in the future. To achieve this target, Brazil would need to resume the successful program (PPCDAM) and deploy other market and regulatory approaches such as traceability of high-risk commodities.
2. ***Create a fund to support reduced deforestation and forest degradation policies***. The ratification or the inception of tariff reductions should be conditioned to the deployment of technical and financial assistance such as the creation of a fund to support sustainable land use (See Box 3-6). The fund should focus on regions with highest risks of direct and indirect deforestation taking into account the likely displacement of land use change – for example, increased land use intensification in one region leading to expansion of deforestation in other areas (Arima et al. 2011 – See also Chapter 2).

3. ***Consult and secure indigenous people's rights***. The EU should condition the ratification of the agreement to proper consultation of indigenous peoples and the establishment of secure land rights and adequate protection of indigenous lands territories according to the **United Nations Declaration on the Rights of Indigenous Peoples (United Nations 2007)**. In practice this would entail that indigenous territories should be demarcated, and invaders should be relocated/evaded before tariffs reductions.
4. ***Establish legally binding sanctions to address non-compliance***. The TSDC should establish legal binding sanctions similarly to what is provisioned for other issues in the EMTA. It is worth noting that trade agreements that use sanction to settle disputes, such as has been adopted by the US, has stimulated the adoption of best practices before trade agreements are ratified (Bastiaens & Postnikov 2017). The same authors suggest that such an approach works in developing countries that are highly dependent on trade with the US. However, even if the TSDC provisions were binding, the long process to address violations would be insufficient to curb the surge of deforestation.
5. ***Establish time-bound responses to EMTA violations***. The Parties should reduce the duration of the environmental dispute settlement. The EMTA could consider the model of the United States - Mexico - Canada Agreement (USMCA) that created a Rapid Response Labor Mechanism in charge of quick monitoring and enforcement of provisions (US Trade Representative 2020).
6. ***Establish mandatory best practices***. Given the current systemic failures of environmental policy in Brazil, the EMTA should require the adoption of best practices such as independent certification (See Box 3-7), traceability of products, due diligence, and consultation with indigenous communities before investing.
7. ***Expand and improve the scope for civil society participation***. Echavarría et al. (2020) recommend the EMTA to expand and enhance the space for civil society participation, including involvement in TSD sub-committees, creation of mechanisms for dialogue with governments, provision of funding so civil society can monitor its implementation and participate of meetings.

BOX 3-5 .
THE EUROPEAN PARLIAMENT RESOLUTION ON THE EU'S ROLE IN PROTECTING AND RESTORING THE WORLD'S FORESTS

In September 2020 the European Parliament (EP) approved a resolution on how the EU can protect and restore the world's forests (European Parliament, 2020), including the following.

The European Commission should **better assess the impact of existing trade agreements on deforestation, biodiversity and** human rights. Then, the EC should include more ambitious forest protection, biodiversity and sustainable forestry provisions in the trade and sustainable development chapters of all free trade and investment agreements. The EC should consult with relevant stakeholders, and incorporate the findings in the negotiation and conclusion of such agreements.

The EP stressed that the EU should include **clear commitments against deforestation in all new trade agreements including Mercosur and others**.

The EP invited the EC and Member States:

- to support an EU technical and financial instrument to **catalyze funding to support partners' efforts** to sustainably use, protect and restore forests, improve sustainable, deforestation-free agricultural production, and address mining activities with adverse impacts on forests, under the upcoming Neighborhood, Development and International Cooperation Instrument (NDICI);
- to provide **support to partner countries** with measures the EU may set up **to address imported deforestation** and calls for increased cooperation and the adoption of measures to prevent the displacement of deforestation and forest degradation to other regions of the world;
- to integrate provisions on deforestation and forest degradation, as well as the degradation of other natural ecosystems, biodiversity loss and human rights violations, into development policies and **all investment and support programmes aimed at producer countries and to consider making investments and support conditional on compliance with these elements**.

The EP requested the EC to **propose a regulation to ensure sustainable and deforestation-free supply chains for products placed on the EU market.**

Moreover, the EU trade and investment should include binding and enforceable sustainable development chapters that fully respect international commitments, in particular the Paris Agreement, and are compliant with World Trade Organization (WTO) rules. The EP called the EC to use the new provisions of the **Anti-Dumping Regulation concerning the environment and climate policies**.

BOX 3-6.
A FUND TO MITIGATE THE RISK OF DEFORESTATION ASSOCIATED WITH THE EMTA

The fund should finance sustainable land uses, mostly smallholders in high deforestation risk areas. For example, the fund could cover the direct costs of adopting best practices, as insurance for loans, as a means to reduce interest rates conditioned to environmental performance and to provide high-quality technical assistance in combination with emerging initiatives by private sector in the region (See examples UNEP 2013, UNEP/ITC/ICTSD 2012, Redden 2017, Barreto & Muggah 2019, DW 2020, Vilela 2020). The fund should be ready for disbursal immediately given that deforestation tends to increase within three years of ratification (Abman & Lundberg 2020).

We estimated the potential fund size considering six deforestation risk scenarios and the cost for avoiding deforestation (opportunity cost of foregoing agricultural use) in the Amazon arc of deforestation[13] (US$ 16.36 or €13,9/ton CO2 Silva et al 2019a) and 15% transaction and administrative costs.

The fund would range from one billion to 2.4 billion Euros (Table 3-2). The mitigation costs would be higher in a scenario with weak law enforcement, no rotation cropping plus higher trade elasticities (meaning that people would buy more for a given reduction of tariffs than the standard scenario). This range of mitigation costs (1 to 2.4 billion Euros) could be recovered with the equivalent of six months to a year of the additional financial gains from the EMTA (Table 3-2).

Who should contribute to the fund? One potential approach is to split the costs by the member states according to their estimated financial gains associated with the EMTA. Using this approach, the EU would contribute more because the region would earn most of the economic benefits (average of 68% of the six scenarios estimated by Taheripour and Aguiar (Chapter 1 of this report). Brazil and the other Mercosur countries would earn, respectively 23% and 9% of the benefits.

Table 3-2. Estimated costs of avoiding deforestation associated with the EMTA.

Trade elasticity scenarios	Deforestation and cropping scenarios	Metric tons of CO_2 emmited due to land use change	EMFTA estimated gains (welfare) per year	Total cost of avoided deforestation (one payment)	Number of years of EMTA gains (welfare) to cover the cost of avoided deforestation
Standard	Low deforestation, multiple cropping	75,000,000	€ 2,192,000,000	€ 1,042,372,881	0.5
	High deforestation, multiple cropping	91,000,000	€ 2,184,000,000	€ 1,264,745,763	0.6
	High deforestation, no double cropping	122,000,000	€ 2,183,000,000	€ 1,695,593,220	0.8
Higher	Low deforestation, multiple cropping	100,000,000	€ 2,320,000,000	€ 1,389,830,508	0.6
	High deforestation, multiple cropping	120,000,000	€ 2,301,000,000	€ 1,667,796,610	0.7
	High deforestation, no double cropping	173,000,000	€ 2,301,000,000	€ 2,404,406,780	1.0

[13] The so-called arc of deforestation concentrates deforestation in the eastern and southern portions of the Brazilian Amazon.

BOX 3-7.

THE IMPACT OF INDEPENDENT CERTIFICATION ON SOCIAL AND ENVIRONMENTAL INDICATORS

Some studies reveal that independent certification, although not a panacea, may lead to better environmental and social results. For example, DeFries et al. (2017) found that certification of tropical agricultural commodities (bananas, cocoa, coffee, oil palm, and tea) by smallholders was associated on average with positive outcomes for 34% of response variables.

Another review of 97 studies (Meenken 2020) found that small farmers adopting sustainability standards received 20–30% higher prices than their non-certified counterparts. Certified farmers had higher profits which led to 16–22% higher household incomes. The authors also found significant variability in profits which points to the need to consider specific local conditions that may affect profitability associated with certification.

A study in São Paulo State, Brazil revealed the relevance of demand for certified forest products from Europe. Silva et al. (2019b) found that properties with independently certified forest plantations had higher rates of native forest cover regeneration than non-certified properties. Although the restoration of native forest was a legal obligation, the demand for certified products pushed landholders to comply with regulations.

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Imazon 30 years

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