



Forest Trade on the Amazon Frontier and Its Interaction with the EUDR

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Abstract

This article analyzes how the European Union's Deforestation-Free Products Regulation (EUDR) could affect the production of forest goods in Mato Grosso (MT), a Brazilian state whose economy depends on commodity exports. The text is divided into five topics: the first discusses the context of forestry products in the Brazilian state; the second analyzes the trade in forestry goods in the EU, its regulation, and the prospects for its application in MT; the third offers a conceptualization of the Brussels Effect and its manifestation in Brazil; the fourth one presents the results of field research with actors in the forestry sector in the state, exploring their perceptions about the EU Brussels Effect; and the last one analyzes which Mato Grosso's municipalities are more exposed to the EUDR in their timber exports. The results obtained through semi-structured interviews highlight the diversity of knowledge of the different groups interviewed about European regulations in the country's timber forestry industry. State authorities show a clear awareness of the influence of EU regulations, mainly concerning local public policies and international pressure on deforested areas in the Amazon. Stakeholder perceptions reveal a complex intersection between environmental, economic, and social concerns, highlighting the importance of constructive dialogue between different actors to mitigate conflicts and promote sustainable practices in the forestry sector, in line with global and local conservation demands for environmental and sustainability. Additionally, more than 80 Mato Grosso municipalities will be directly impacted by the EUDR, given their export profiles.

Keywords Forest goods · European regulation · Brazil · Deforestation

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1 Introduction

The study of the Brussels Effect and trade in timber forest products is based on the strategies and processes for promoting sustainability in countries, regions, and integrated spaces, such as the European Union (EU). As the world's largest single market, the EU's decisions on consuming and importing certain goods directly and indirectly affect third countries. In the face of the climate emergency, promoting sustainability is a global priority, and the EU can reflect its sustainable standards externally. However, this quest for sustainability can negatively impact countries in the Global South, which face serious social problems and have economies based on primary products.

This paper analyzes how the Regulation for Deforestation-Free Products of the European Union (EUDR) [1] could impact the production of forestry goods in Mato Grosso (MT), a Brazilian state whose economy depends on the export of commodities. The EU is one of Brazil's largest trading partners for forest products, and any policy change directly affects the Brazilian scenario, especially in MT. The EU's new regulations increase the strictness with which forest products associated with deforestation enter its market, which puts pressure on Brazilian producers to adapt to these standards, regardless of changes in national legislation. This exemplifies the regulation of foreign trade by EU provisions, materializing the so-called Brussels Effect [2, 3].

The text is divided into five topics: the first discusses the context of forest products in Mato Grosso; the second analyses trade in forest goods in the EU, its regulation, and the prospects for its application in MT; the third offers a conceptualization of the Brussels Effect and its manifestation in Brazil; the fourth presents the results of field research with stakeholders in the forestry sector in Mato Grosso, exploring their perceptions of the Brussels Effect; and the last one proposes an imputation of timber exports for the Mato Grosso municipalities, in order to properly measure the exposition of these municipalities' timber production to the EUDR.

2 Materials and Methods

This section details the methods employed in this paper, which can be divided into a subsection detailing the semi-structured interviews carried out in this paper; and a subsection detailing the procedure used to impute timber export by Mato Grosso across its municipalities.

2.1 Interviews and Questionnaires

The study used an electronic form for the interviewees containing twelve questions (Annex I) to structure the Likert Scale [4]. Three groups were surveyed: entrepreneurs (who work with planting native and exotic species), state employees

(legislative and executive branches), and third-sector employees. A total of ten people¹ were interviewed, and a non-probabilistic analysis was conducted by judgment sampling, given the interviewees' connections with the forestry sector, which constitutes an exploratory qualitative analysis. The questions were asked using a Google form between August and September 2023.

The form aimed to establish the interviewees' degree of perception of the influence of the European Union's environmental regulations on the timber sector in Mato Grosso. The scale consisted of:

1. Strongly disagree;
2. Disagree;
3. Neither agree nor disagree (neutral);
4. Agree;
5. Strongly agree.

The questions were not compulsory, and those left blank were given a value of 0, as it was understood that the average proposed by the methodology would not meet the objectives of this research [4]. After collecting the data in Excel spreadsheets (Annex II), the statistical analysis was carried out using the R software, generating a graph with percentages in bars, sloping towards disagreement or agreement.

The evidence found in the interviews was presented and analyzed in light of the literature review. In addition, this chapter sets the stage for discussion and the weighing up of critical judgments on the opinion of the authors.

2.2 Measuring the Exposition of Mato Grosso's Municipalities Timber Production to the EUDR

Underlying the legal discussion of the EUDR and timber trade in Mato Grosso is an apparent inability of the research to gauge which municipalities are more exposed to the EUDR. Answering these questions directs *ex ante* analysis regarding the possible effects of the EUDR on the timber trade in the Mato Grosso state. At the same time, this analysis also informs the kind of *ex post* exercises to be made once the EUDR has already affected the trade of selected products. Whether EUDR will be effective in changing the way the timber trade occurs is something to be seen in the medium to long term.

To assess *ex ante* exposure of Mato Grosso municipalities to EUDR, it is devised a very generic method that attributes the export of timber that is concentrated in exported, not producing, Mato Grosso municipalities. This analysis uses a kind of regionalization of economic variables that leverages different aspects of the economy to qualify the municipal timber exporter sectors. This analysis allows one to

¹ This sample size does not allow for representative analysis regarding the way stakeholders answer to the influence of the European Union. Hence, this does not constitute either a representative quantitative profiling of these stakeholders' perceptions or a quantitative analysis. This paper uses these interviews to contextualize its findings and arguments.

understand more thoroughly the exporting profile of different municipalities that are not seen, in terms of official statistics, as timber exporters. This procedure allows to indirectly analyze which municipalities will probably exert more effort to satisfy the EUDR. First, subSect. 2.2.1. contextualizes the analysis in terms of down-scaling and regionalization, deriving from both methods the insights used in this exercise; subSect. 2.2.2, it is explained the mapping used from labor data to export data, which allows expanding timber exporting data over several municipalities; finally, this method is applied in a further section to analyze the exporting profile of timber by Mato Grosso municipalities, in terms of their producing capabilities. This analysis is more capable of delivering insights into timber production-trade nexus than only the trade aspect of timber. This paper builds on works of input-output, regional sciences, and recent studies analyzing the effect of EUDR on soy and meat [5]. This paper differs from these studies by considering that overall exposure of Mato Grosso exports. Given the fact that all selected products directed to EU must abide to EUDR, analyzing only recent deforested producing areas tends to underestimate EUDR's reach. At the same time, all products that aim to be exported to the bloc, whether compliers or not with the EUDR, will have to attest traceability and due diligence processes in their supply chain. Moreover, EU aims to diffuse regulation, via the Brussels effects, which would change the whole supply chain of several goods directed to the foreign market. Hence, this all-encompassing analysis can be seen as an upper bound to the influence of EU on the foreign market production of Mato Grosso's timber.

2.2.1 Spreading a Variable Across Space: Possible Alternatives

In regional sciences, it is very common to have variables at a certain level (national vs regional), while having the need of this variable to exist at a lower regional level, such as municipality. Regional Sciences usually solve this problem by downscaling a variable, that is, using a different variable at the desired level that can help to increase the cover of a national or state variable. As example, suppose data on Mato Grosso municipalities' GDP, and Mato Grosso overall unemployment- in number of persons unemployed- is available. Municipal GDP can be used to devise the following weight:

$$weight_i = \frac{GDP_i}{GDP_{MT}} \quad (1)$$

where, $weight_i$ is the weight of municipality i , while GDP_i is its GDP e GDP_{MT} is the Mato Grosso GDP. By definition, $weight_i \geq 0$ for all i and $\sum_{i \in I} weight_i = 1$. In the present case, how does one recover the municipal unemployment from Mato Grosso overall unemployment number? Using following formula is an alternative:

$$unemployment_i = weight_i * unemployment_{MT} \quad (2)$$

This is a possible way to spread a variable over the space. There is often more complex analysis that uses spatial econometrics analysis such Bayesian Spatial

Probit, which allows for deciding which spatial units have the occurrence of the event. A further weighting procedure that considers only selected municipalities is also possible.

2.2.2 Coefficients of Spreading Mato Grosso Timber Exports

Crucial to one analysis is how to build then weight (or share) object. In the previous example, the share of municipal GDP on the state GDP is used to devise a weight option for municipal unemployment. Ideally, $weight_i \geq 0$ for all i and $\sum_{i \in I} weight_i = 1$. Any form of construction of this $weight_i$ that respects this summation can be spatially sound, at least at a mathematical level. However, does that make economic sense? In this example, one might use GDP to spread unemployment over municipalities considering that GDP depends on capital, labor, and other fixed factors in productive terms.

In this case, to gauge which municipalities produce the most timber directed to exports requires some ingenious estimation of the timber sector in the Mato Grosso municipalities economy. This logic is applied here to spread the Mato Grosso exports of timber over Mato Grosso municipalities. In our case, municipal labor data on the timber sector is used to gauge the weight of a municipality in the Mato Grosso state timber production. But how does one recover labor employment in the timber sector? Labor data, more specifically RAIS, is used to tackle the timber employment in Mato Grosso municipalities. RAIS is a large labor dataset for Brazil that identifies each sector and municipality of employment. The mapping from RAIS sector of employment to export data's activity is not trivial and an indirect mapping is devised to understand the weight of tradable products in the RAIS, with a focus of timber production.

In practical terms, there is a complete mapping from HS6 into NCM and CNAES into NCM. So, the connection between RAIS' CNAES code into trade data's HS6 happens through a very detailed and HS6-derived NCM coding. It is important to understand that not all RAIS sectors will be mapped onto a HS6 code, given that there are non-tradable activities in RAIS for which HS6 does not account.

This mapping considers linking a HS6 code of interest allows a type of weight that considers labor workforce in a specific sector. In the present case, for instance, it is intended to examine the weight of the formal timber labor force in Mato Grosso state's overall formal timber labor force. The highest the weight of a municipality in this Mato Grosso formal labor force, the highest its timber exports when considering the total exports by Mato Grosso.

This mapping considers the mapping from RAIS into Comex Stat data, with an underlying hypothesis that all RAIS employment in timber can be used for exports. This hypothesis might not stand a more nuanced data consideration, however there is no other data that allows for this examination. Hence, this is the best guess for this result.

3 Production, Trade, and Regulation of Forest Products in the Context of Mato Grosso

Mato Grosso is a Brazilian state located in the Center-western region of Brazil, which has three biomes in its territorial space. According to Instituto Brasileiro de Geografia e Estatística (IBGE) data [6] (2024), it is the third-largest Brazilian state, with 903,208.361 km², of which 56.67% is in the Amazon biome (512,000 km²), 37.40% in the Cerrado biome (337,940 km²) and 5.93% in the Pantanal biome (53,582 km²) and one of the states that constitute the Legal Amazon, a regional planning delimited by the Brazilian government that comprises the states that are home to the Amazon biome. The state has a strong commodities sector, a significant soy, timber, and livestock producer, and the primary industry sustains its economy.

The state's commercial profile is marked by the export of agricultural and forestry products, which we will focus on. Mato Grosso's commercial forestry profile is based on the production of Roundwood, profiled, and sawn timber, the vast majority of which is hardwood-sawn timber from the rainforest, native wood. The state is home to the largest teak plantation, an exotic species that has gained ground recently and is mainly destined for export [7, 8].

Over the last twenty years, the USA, China, India, and the EU, especially France, Belgium, Italy, Spain, Germany, and Denmark, have been among its biggest trading partners in terms of forestry [8].

Analyzing the exports of sawn timber, profiled timber, and raw timber from Mato Grosso in 2023 [9], the countries that most import these three types of timber from Mato Grosso are:

1. India: with raw and sawn timber;
2. China: raw and sawn timber;
3. United States: with profiled timber;
4. EU, with Germany, Portugal, Belgium, and France: all three types of wood.

Thus, profiled timber has the highest added value since its processing involves an additional process, giving this product greater value. The EU stands out as one of Mato Grosso's most active trading partners, especially in exporting profiled timber, where it has the largest market share and a higher market value than other trading partners [8].

Since 2003, the export scenario for forestry products has been changing. In 2003, most wood exported to the EU was sawn timber and plywood. On the other hand, since 2013, 10 years later, profiled timber has gained ground, accounting for more than half of Mato Grosso's exports to the EU, and will continue to do so until 2021, the last year for which statistics are available from the National Forestry Information System (SNIF).

Mato Grosso has 4.7 million hectares under management. By 2030, producers intend to reach the 6 million mark, with a production of around 4 million cubic meters per year, accounting for 300 million reais in 2021, in addition to being the economy that drives 44 municipalities in the north of the state [10], around 31% of

the municipalities in their entirety. The state has 4% of the timber companies in Brazil, and the primary raw material for these industries comes from native forests and tropical species extracted through the PMFS [7].

As a result, the forestry sector in Mato Grosso occupies a prominent role. It is the 9th largest tax collector in the state, employs 12% of industry workers, and generates 90,000 jobs [11, 12]. The sector is crucial in social terms, developing and maintaining employment, and economic and fiscal terms.

Additionally, products such as cellulose, flooring panels, wooden furniture, and MDF fiber panels play a significant role in trade between Mato Grosso and the EU. Notably, 100% of OSB particleboard, waferboard, sawdust, and wood waste are exported to the EU [9]. Between 2003 and 2021, the EU represented nearly 23% of the FOB value in this trade [9].

Another key factor shaping trade between the EU and Mato Grosso is the production of wood from native forests. In 1998, roundwood production was around 28 million cubic meters, but by 2018, it had dropped to 8 million cubic meters [13]. This significant decline is mainly due to the growing perception that the sale of native timber is closely linked to deforestation, which is often viewed as inherently harmful or even illegal. In other words, there has been an increasing assumption that the production of forest products from native wood is either illegal or, at the very least, highly detrimental.

Nevertheless, *sensu stricto*, “deforestation” can be defined as removing vegetation cover by cutting, weeding, burning, or using chemical products [14]. In legal terms, the concept of deforestation in Brazil is that of “alternative land use” established by the Brazilian Forest Code of 2012 (Federal Law n°. 12.651/2012) [15] in its Article 3, VI as the replacement of native vegetation and successor formations with other land cover, such as agricultural, industrial, power generation and transmission activities, etc. Thus, the Brazilian legal regime does not prohibit the economic exploitation of forests, even native forests, or the suppression of its vegetation, but regulates it, establishing appropriate use standards and specific limitations, such as specially protected areas.

Based on this definition, two points should be highlighted: firstly, the general concept of deforestation, in the strict sense of removal of vegetation, does not automatically result in illegality. Alternative land use is regulated and legal, and illegality is only committed in the case of deforestation in disagreement with Brazilian environmental standards, according to Art. 2, § 1 of the same standard [15]. Furthermore, deforestation is not an automatic synonym for the economic exploitation of forest products, which does not necessarily translate into an illegal act. Article 31 of the Forest Code allows for commercializing native vegetation and succession formations on public or private land. However, this will depend on authorization from the government through environmental licensing and prior approval of the so-called Sustainable Forest Management Plan (PMFS).

Sustainable Forest Management (SFM) is defined by Article 3, IV of the Brazilian Forest Code as the management of natural vegetation to obtain economic, social, and environmental benefits while respecting the support mechanisms of the ecosystem in question [15]. Hence, SFM is how native timber is extracted and sold, and it cannot be considered deforestation since it does not remove the soil cover. In

management, there are no changes in land use, as the soil remains covered, with the extraction of certain species of mature trees that are economically viable and not prohibited, as well as meeting the requirements of the lowest possible impact on their felling and being in a rotational logging area.

In general terms, SFM is one of the few ways to exploit native Brazilian forests economically. It should not be confused with deforestation, which, once again, is the removal of soil cover and the conversion of land use. Again, it should not be confused with an illegal act.

Furthermore, MT has a history of implementing strong policies for sustainable forest management, having regulated the practice since 2006 through State Decree No. 8.188 (2006).

In addition, at the federal level, critical components of Brazilian forestry policy include the National Environment Policy (PNMA) and the Forest Code. Therefore, Brazil has established a robust legal framework for forestry that is considered one of the most comprehensive and environmentally protective globally. This framework includes various command and control instruments, such as specially protected areas (Legal Reserves, Permanent Preservation Areas, and Conservation Units), as well as economic instruments like Payment for Environmental Services (PSA), which play a significant role in advancing the conservation of forests.

As previously mentioned, the deforestation that is effectively monitored and combated is that which violates Brazilian forest standards and regulations—namely, illegal deforestation. In terms of federal policies aimed at addressing illegal deforestation in the Legal Amazon, the key instrument is the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAM), introduced by the Brazilian federal government in the early 2000s. This plan, alongside more robust strategies and increased oversight, led to a significant reduction in deforestation, which remained relatively stable between 2004 and 2018. However, deforestation rates began to rise sharply after 2018. Despite these challenges, the 5th phase of PPCDAM, combined with the Amazon Fund and the National Climate Change Policy, marks a renewed federal effort starting in 2022, with the goal of achieving zero deforestation by 2030 [16].

Therefore, Brazil, both at the federal and state levels, especially with MT, is strongly committed to addressing environmental issues through comprehensive and innovative forestry policies. However, implementing these policies faces challenges due to a lack of infrastructure, skilled personnel, legislative setbacks, and the need for increased investments and studies in biomes such as the Cerrado and Pantanal. Similar challenges are also observed at the state level, where despite multiple issues and hurdles in policy implementation, the state of Mato Grosso has made significant progress in environmental policies. They have recognized the importance of implementing robust measures to preserve their forests and ecosystems. Initiatives such as PMFS are crucial in ensuring traceability and combatting deforestation, strengthening Mato Grosso's commitment to forest conservation, and positioning the state as a responsible partner in forestry relations, particularly concerning exports with the EU, as will be seen in the next topic.

In addition, it is clear from the above that trade in timber forest products is one of MT's economic pillars, driven by international demand for native and exotic timber,

both raw and processed. That said given the reduction in exports and the greater rigidity of global trade and forestry regulations, as will be seen in the next topic, small and medium-sized companies are declining, a factor that impacts the labor force of the workers involved. Small and medium-sized entrepreneurs and producers in the industrial sector accounted for 12% of the state's manufacturing jobs in 2017. Industrialization in this sector makes it possible to value and improve the local workforce.

In conclusion, the forestry sector in Mato Grosso plays a crucial role in the state's economy, driving tax revenue and job creation. Nevertheless, this trade's sustainability hinges on more than just economic factors; it also depends on rigorous environmental regulations and sustainable practices. Brazilian legislation, particularly the Forest Code, does not inherently prohibit the exploitation of forests but regulates it through mechanisms like Sustainable Forest Management (SFM), which allows for the economical use of forests without deforestation or soil degradation. SFM practices, by enabling the extraction of timber while maintaining forest cover, present a legally viable path for Mato Grosso to balance economic interests with environmental protection.

Although Brazil and Mato Grosso have favorable forestry policies and legislation, adhering to the strict environmental standards required by the EU presents a significant challenge for producers. This is due to various issues in the final text of the regulation and its creation process. As a result, producers and their governments face significant pressure, known as the Brussels Effect, which will be discussed next.

4 Relevance of the Timber Trade to the European Union and its Regulation of Environmental Products

As the above topic shows, the EU is prominent in MT's trade balance, although it is also essential for the national economy. The EU is Brazil's second-largest trading partner, accounting for 18.3% of its total trade flow, and Brazil is the country that exports the most agricultural products to the EU [17].

Trade in Brazilian timber has been significant for the EU since at least the nineteenth century, mainly due to the supply of raw materials. Brazil is known for its vast forest resources and is a significant exporter of timber products to the EU [17]. The Netherlands (Holland), Germany, Spain, Italy, and Belgium are the leading destinations for Brazilian exports. Around 6.0% of Brazilian pulp exports go to the European Union [18].

Also, although, as already established, the EU's share of Mato Grosso's native timber export market has decreased over the past two decades, its overall participation has grown. Between 2018 and 2023, the EU's share of the state's timber exports increased from 24.36 to 30.48%. Regarding FOB value, the EU accounts for almost a third of Mato Grosso's exports, making it a crucial trade link [8]. In the first quarter of 2023, the EU imported 427,000 tons of tropical wood and wooden furniture from Brazil, corresponding to 896 million dollars of traded value. Compared to the same period last year, there was a 12% reduction in the sale of tropical wood and a 22% reduction in wooden furniture [19]. According to the ITTO report of January

2024, one of the reasons for the fall in exports and prices of tropical timber over the last 18 months has been European requirements and “new measures in the sustainability performance of the timber sector” [20].

Brazilian wood is, consequently, essential for the EU, which is seeking to diversify its import sources to ensure a sustainable supply chain. The bloc alternates acquiring this raw material mainly between countries such as Bosnia and Herzegovina, Brazil, Cameroon, and China [21].

Regardless of Brazil’s contribution to European imports of forestry products, the country also stands out for a negative aspect: the “deforestation incorporated” by the EU, purchases of illegally sourced wood, or suspiciously, which, around 48%, comes from Brazil. These alarming figures highlight the importance of addressing the issue of deforestation and illegal trade in forest products in Brazil. In commercial terms, it is predicted that the trade in forest products in Brazil will quadruple by 2030, reaching the mark of 21 million cubic meters traded per year [22].

To understand the extent to which Brazil contributes to “deforestation embodied” in goods imported by the EU, and how much European countries, intentionally or not, finance illegal deforestation in Brazil, the Ministério Público Federal (MPF) provides some revealing data. Between 2017 and 2020, approximately 78,953 m³ of illegal timber were confiscated at the Port of Manaus, in the state of Amazonas, from companies that extracted the wood without authorization. The declared value of this seized timber was R\$ 306,100,419.59, of which R\$ 203,441,651.04 and 58,686.01 m³ were destined for European countries, mainly Belgium, the Netherlands, France, Portugal, and Germany [23].

In that sense, concerning Sustainable Development, the EU has expressed its commitment to taking a global leadership position in implementing the 2030 agenda and the SDGs together with the Member States, enabling a joint approach to the European Union’s external policies and actions. Thus, the EU has a long history of policies and legislation in defense of the environment in pursuit of sustainable development, such as the European Green Deal, which includes the New EU Forest Strategy 2030, the Climate Law, the Circular Economy Action Plan, European Agri-Environment Regimes.

The European Green Deal has been a key EU instrument for tackling the problems and challenges of climate change and the environment. It establishes a comprehensive growth strategy that aims to transform the EU into a prosperous, fair society with an optimized economy that is competitive while efficient. To this end, economic growth by 2050 must be decoupled from the exploitation of natural resources [24].

The EU aims to achieve high resource use and management efficiency to achieve carbon neutrality. This requires harmonizing internal regulations and intensifying bilateral dialogues with partner countries for governance purposes.

The Green Deal also raises concerns about forests, given that forest ecosystems are under tremendous pressure, requiring reforestation, fire prevention, and investment in carbon storage. It has therefore set the following priorities: reducing the EU’s consumption footprint by encouraging products from supply chains not associated with deforestation; working in partnership with producers to reduce pressures on forests; strengthening international cooperation to halt deforestation and forest

degradation and encourage forest restoration; redirecting funding to support more sustainable land-use practices; supporting the availability of information on forests and commodity supply chains, the quality of this information and access to it, supporting research and innovation [25], protecting human rights [26].

Given the EU's growing concern with the sustainable and legal timber trade, it has implemented several regulations, such as the EU Timber Regulation (EUTR), Regulation (EU) N°. 995, 2010, and the current EUDR aimed to combat importing products linked to illegal deforestation. These regulations have defined the obligations of operators who place timber and timber products on the market, creating legal mechanisms to combat the illicit trade in domestic and international production. These regulations cover many products, such as solid wood, flooring, plywood, pulp, and paper [23]. Many of the goods exported by Mato Grosso are included in the EUDR; however, a significant portion of these are unable to comply with European standards, which justifies the loss of the EU's share of Mato Grosso's state trade.

The EUDR, published in June 2023, replaced the old regulation governing the timber trade, the EUTR. The new regulation's *animus legis* is to combat deforestation associated with imports from the EU. Article 9 introduced a new, innovative, and essential requirement to prevent deforestation: traceability of the origin of goods in the production chain. This new system imposes georeferencing as a fundamental tool in guaranteeing the origin of forest products sold [1].

Regarding traceability of origin, the European Commission explains that information on forest management, legislation, and potential risks of illegality in timber-supplying countries helps the competent authorities apply a risk-based approach. Verifying operators' good environmental practices also includes supporting improvements in production techniques and processes and integrating risk management as part of their Due Diligence System [27].

The EUDR seeks to recognize the impact that EU imports of commodities have on the forest areas of exporting countries. In doing so, it aims to tackle embedded deforestation, especially in the trade of agricultural products, which affected around a third of the products consumed worldwide between 1990 and 2008 [28]. In general terms, the standard aims to demonstrate that commodities imported by the EU do not have deforestation or forest degradation in their supply chain after December 31, 2020.

In addition, the EUDR addresses forestry and broadens the scope of regulatory protection for commodities compared to previous regulations. Called "relevant commodities" by the regulation, it now covers "cattle, cocoa, coffee, oil palm, rubber, soy, and wood" (Arts. 1 and 2) [1]. Another expansion was the objective of the regulation, which now prohibits the placing and making available on the domestic market of products and their derivatives that have been manufactured or produced through deforestation or forest degradation processes.

The EUDR has introduced stringency to the trade in forestry products and extended its application to cover other wooden furniture and printed materials. Companies in the forestry sector wishing to trade with the EU must adapt to this new, stricter system, which includes extended and mandatory due diligence and increased sanctions [29].

Therefore, the EU plays a significant role in Mato Grosso's trade balance, particularly in the forestry sector, while also being vital to Brazil's national economy as its second-largest trading partner. The historical ties between Brazil and the EU in timber exports have made the EU a crucial market, despite recent fluctuations in trade volumes due to stricter environmental regulations. The EUDR, as the latest regulatory framework, underscores the EU's growing commitment to sustainable development and environmental protection, especially in the context of deforestation and illegal trade. Although the EUDR offers an opportunity to enhance sustainable trade practices, it also poses significant challenges for Brazilian exporters, particularly those in Mato Grosso, as compliance with its stringent standards, such as traceability and due diligence, will require substantial adaptation. The prospect of Brazil's timber trade expanding fourfold by 2030 highlights the importance of aligning with international standards, as failure to do so may result in loss of market share and economic setbacks.

5 Implementation of the EUDR in Relation to Brazilian Regulations and its Implications

After outlining the general aspects of European regulations on forest products, particularly the EUDR, and the significance of Brazilian exports to European markets, it is crucial to analyze the EUDR in relation to Brazilian regulations, highlighting problematic areas and their implications for Brazil, especially for the state of Mato Grosso.

First, some of the concepts within the EUDR require further clarification from a legal standpoint. The term "forest degradation," defined by Art. 2, 7 of the regulations as structural changes in forest cover, which take the form of conversion of primary forests and forests undergoing natural regeneration into planted forests, it is unclear as to how it can be detected if the conversion is not immediate [1]. In addition, the notion of "deforestation," defined as the conversion of forest for agricultural use, whether induced by man, in Art. 2, 3, does not clarify how it should be applied when the timber harvest comes from the conversion of primary or naturally regenerating forests. It also does not cover issues such as authorized deforestation, as is the case in Brazil, according to the previous topic.

Therefore, the EUDR covers all forms of deforestation, whether authorized (legal) or not, making no distinction between them. However, by legal provision, Brazil has legal deforestation, a definition that the EUDR does not cover.

The lack of differentiation between legal and illegal deforestation is just one aspect of the problem in Brazil. Deforestation steadily increases in less strictly protected biomes, particularly in the Cerrado region. While legal deforestation is a significant issue that needs to be addressed, treating legal and illegal activities as the same is not fair. It could even be seen as an unjustified barrier to trade.

It is important to understand that EU's decision to restrict imports of products linked to any land use change results from a political process in the European Parliament, which considers various interests, including protecting European farmers. If the EU's interpretation prevails and disregards national laws and official data from

the exporting country, it could violate international trade rules. This could prompt producing countries to challenge the Deforestation Regulation at the WTO, arguing that it creates an unjustified trade barrier [30].

Moreover, although the regulatory scope of the EUDR has expanded compared to the previous normative, there is still a significant gap. The regulation focuses on protecting forests, defining them in Article 2, Sect. 1, as land that measures more than 0.5 hectares with trees taller than 5 m and a crown coverage greater than 10% or trees capable of reaching these measurements, excluding predominantly agricultural or urban land. This definition is relatively narrow, mainly when applied in the Brazilian context, as it does not include biomes of enormous importance in terms of biodiversity and occupied area, particularly harming the Cerrado and the Caatinga.

It is worth mentioning that the EUDR also establishes new responsibilities for producers and traders, which now cover the entire supply chain, generating additional costs for these agents. They must now invest in documentation, reports, geolocation data, etc., to prove that their products are not linked with deforestation or any forest degradation, increasing the bureaucracy in EU trade. These requirements favor large traders with greater resources and visibility over their supply chains, as they can afford the technical expertise needed for compliance. This dynamic may lead to market specialization, disadvantaging small and medium-sized entrepreneurs who struggle to meet these standards, who may need financial support and are historically already committed to more sustainable practices. This potentially supplants the smaller producers from the market, creating an uneven playing field, diminishing the competition, and consequently raising costs for European consumers [31].

Although the innovations contained in the EUDR are of great importance in the search for forest sustainability for this modernization to be effective, more than mentioning them in the legislation is needed, as they require clear and systematically correct conceptualization [32]. As long as the EUDR is clear about deforestation and forest degradation, its effectiveness will be protected.

The context provided highlights the shortcomings of the EUDR's governance process. While the EUDR's development was supported by the Multilateral Platform and the Global Gateway, designed to enhance dialogue with third countries, the outcomes fell short of expectations. Despite bilateral and multilateral consultations with key timber-exporting countries like Brazil, Malaysia, and Indonesia, as well as over 1.2 million responses to a Public Consultation, the final text of the regulation did not fully reflect the realities of producer countries. Issues such as the exclusion of biomes like the Cerrado and Caatinga in Brazil, the lack of distinction between legal and illegal deforestation, and the limited capacity of small and medium-sized producers were overlooked. Consequently, concerns from Global South countries persist, indicating that the governance process failed to address their core challenge.

To prevent these effects, the EUDR incorporated cooperation with third countries in its Article 30 (2), providing mechanisms for the transition as follows: "Partnerships and cooperation shall allow the full participation of all stakeholders, including civil society, indigenous peoples, local communities, women, the private sector, including microenterprises and other SMEs, and smallholders" [1].

However, it is unknown how this fund will be applied and whether it will reach those directly and indirectly involved in the forestry sector. This is a

challenging task, given that the number of municipalities affected in Mato Grosso alone corresponds to 31% of the state's municipalities.

In addition, the fund aims to make the transition between regimes less damaging in short-term social terms. However, this influence is likely to have side effects in the long term, such as discouraging the consumption of wood by end consumers. This scenario would weaken the forestry sector and, consequently, a crisis in the economic and social spheres.

Given the scenario presented in the countries of the Global South, where socio-economic inequality has persisted since colonization, the new regulations risk exacerbating it due to this external influence. This will result in extensive social damage, such as unemployment, hunger, a decline in essential activities for municipalities that depend on forestry trade, and problems related to health and education, among others.

A final observation worth making stems from the FLEGT license, which, according to Article 10(3) of the EUDR, considers the products covered by this license valid because they comply with the legislation applicable to the countries that produced the commodity. Consequently, this wording can be considered pressure from the EU for third countries to sign the FLEGT partnership, as it is considered one less bureaucratic obstacle.

Thus, if the timber traded by Mato Grosso is considered high risk, under the terms of Article 29 (1) of the EUDR, because it represents around a third of the trade in the forestry sector in Mato Grosso, there would undoubtedly be a significant social impact, especially on the groups of workers highlighted above. As for the environmental impact and the reduction in deforestation, there is no evidence that the estimated reductions would be achieved. The decrease in the market flow with the EU, one of the countries that pays the highest market value for timber, would open up space for new markets or intensify existing trade flows. The decrease in market value will likely put even more pressure on forest areas, which will have to produce more kilograms to meet the reduction.

Reducing market quotas or not trading timber with Mato Grosso will not reduce deforestation rates and could even have a rebound effect, putting more pressure on other biomes. If the EUDR only maintains its protection for forests, the Cerrado will continue to be under pressure, and deforestation rates will rise. Most, if not all, of the effects mentioned above are caused by the Brussels Effect, as will be analyzed in the following section.

The EU is a crucial trading partner for Mato Grosso and Brazil, especially in the timber sector. The implementation of the EUDR, although aimed at sustainability, brings significant challenges for local producers, increasing costs and bureaucracy. A balance must be struck between the EU's sustainability requirements and the economic viability of small and medium-sized Brazilian producers. The transition to more sustainable practices must be accompanied by adequate financial and technical support to minimize negative socio-economic impacts. In this way, sustainable trade can be guaranteed to benefit both the environment and local communities.

6 The Brussels Effect and its Forestry Dimension

Conceptually, the Brussels Effect is the “unilateral power to regulate global markets without the need to use international institutions or seek other nations’ cooperation” [2]. Bradford reports that the EU can establish regulations that shape global trade, generating a “Europeanization” of essential aspects of international trade.

The Brussels Effect essentially leads to a unilateral regulatory globalization, in which EU regulations are pursued economically throughout the world market. This effect can occur in two ways: *de facto* or *de jure*. The *de facto* Brussels Effect occurs when large companies adjust their production and conduct to the rules set by the EU. The *de jure* Brussels Effect occurs when foreign governments adopt European regulations; it stems from the *de facto* Brussels Effect, in that after adjusting, large corporations will lobby their home jurisdictions to adopt European standards. Therefore, the Brussels *de jure* effect often occurs after the Brussels *de facto* effect, as companies from third countries that have adapted to EU regulations want other companies to do the same so that trade is fair. It is by seeking this justice and adjusting the internal regulatory texts of third countries that the Brussels *de jure* effect will materialize.

It should be noted that the Brussels *de jure* effect is a more imposing form of influence, as it involves rearranging an entire existing regulatory system to adapt to new EU standards.

There are five elements underlying the Brussels Effect: (1) market size; (2) regulatory capacity; (3) strict standards; (4) inelastic targets; and (5) indivisibility [3]. According to the author, these elements are cumulative and indispensable for characterizing the effect.

Market size is linked to the attractiveness of its consumer market compared to other existing markets. Thus, “a jurisdiction’s market power is enhanced when firms perceive high value in their access to that market” [3]. Large markets have a gravitational effect on producers and, added to the diversity of the market, lead them to the regulatory standards set by these states [33].

Regulatory capacity is the “jurisdiction’s ability to promulgate and enforce regulations” [3]. The above-mentioned EU bodies are framed in this context. The entire institutional structure, with the Councils, Parliament, Commission, and Court, together with the technical expertise and budgetary allocation, ensures that the EU can regulate the most diverse subjects.

Besides regulating, the EU has sanctioning capacity and mechanisms to enforce its regulations, which makes its influence more far-reaching. Thus, regulatory capacity is also linked to the propensity to enact strict rules, i.e., for the “Brussels Effect” to occur, the jurisdiction must have the capacity to establish strict regulatory standards, which is the third element of the Brussels Effect. For this regulatory capacity to have global influence, it must be accompanied by the political will to implement it, and this will to be a normative influencer exists and is made explicit in European Commission documents, such as the Communication “Reflection Paper for a Sustainable Europe by 2030” [28]. This is one of the

most important elements because without this will to” set the standards for the rest of the world” (p. 15), the Brussels Effect would be as widespread as it is.

Inelastic targets refer to “products or producers that are non-responsive to regulatory change and hence tied to a certain regulatory regime”, such as consumer markets. Since producers do not have a choice as to jurisdiction, if they want to access that market, they cannot circumvent the rules established therein [3].

Lastly, indivisibility. This will occur when multinational companies, after adapting their products and practices to strict regulatory standards, apply them to their production lines, making these standards global [3]. Thus, standardization occurs to meet the most demanding market, as it is economically or technologically unsustainable to change the product/service according to the market in which it is sold.

In the environmental field the Brussels Effect tends to have a significant manifestation, since the European Commission believes that the bloc’s trade policy can and should align with the ecological transition, which will impose respect for the Paris Agreement, making it an essential element of all trade agreements [28]. Considering, as we have shown in the previous sections, the importance of trade relations in forestry products between the European Union and Brazil, with an emphasis on MT in this work, it is clear to see the potential influence that European environmental standards have on this production, which is evident from the results of the survey carried out, set out in the next section.

Therefore, the EU’s ability to exert influence through what is known as the “Brussels Effect” demonstrates the impact of its regulations in countries outside of Europe. The establishment of the EUDR, while aiming to defend the environment and address climate change, still shows some unreasonable aspects. It has been proven that European regulations can influence and impact producing countries, particularly those in the Global South. However, the lack of impact of their participation in drafting legislation on the text itself manifests, in essence, as a serious problem. As a result, there is a mismatch between the EUDR and national legislation in these countries, as already demonstrated on Brazil’s case, leading to difficulties in implementation and effectiveness and potentially harming the more vulnerable nations. This phenomenon not only demonstrates the strength of the European market but also reinforces the importance of institutional capacity and political determination in promoting regulatory change on a global scale, especially in critical sectors such as the environment.

As a result, the regulations established by the EU to determine timber trade standards for operators in its market have transcended borders. They are spread across several countries and companies since adherence can occur individually, in groups, by company, or by region that has adapted to the established standards to obtain the necessary certification to prove compliance with due diligence and to be able to operate in the European timber market.

In this regard, field research was conducted to demonstrate the impact of EU regulations on the forestry industry in Mato Grosso, and its results will be discussed in the next section. Nevertheless, the results generally highlight the Brussels Effect, reflecting the EU’s influence on forestry stakeholders in Mato Grosso.

7 Stakeholder Perceptions of the Brussels Effect

As explained, this topic aims to critically and empirically analyze the Brussels Effect and its negative impacts on the trade of timber forest products based on semi-structured interviews with state public sector bodies, third sector entities, and economic agents. The interviews investigated respondents' knowledge of and attention to European regulations, their impact on exports, and access to EU regulatory innovations. The textual analysis of the transcriptions was carried out using the IRAMUTEQ software, which categorizes the data based on the similarity of the vocabularies to identify elements relevant to the topic studied.

After analysis by the R software of the scores given by the interviewees about the questionnaire, the following graph was generated:

The questions were reduced by theme to help the graph be better visualized. The nomenclature P1 means the first question, and so on.

In an analysis of the answers, the change of federal government was chosen as the most important, corresponding to 75% agreement. This data means that question 1, "What influence has the change of federal government had on your area of activity?" was the one that obtained the most points and agreement on the Likert Scale. The latest change in the federal government has unquestionably impacted environmental policies, and all the interviewees feel this influence in their respective areas. The change of government brought new contours to Brazilian forestry policies, such as the return of the PPCDAm to control and preserve the Amazon, the return of the Amazon Fund, the fight against deforestation and environmental crimes in a more emphatic way, strengthening and restructuring ecological agencies, as well as support for family farming.

An critical finding was question 4, "How would you rate the EU's influence in your sector?" which comes in second place among the questions with the most significant weight, corresponding to 60% agreement. This means that most respondents give great weight to the EU's influence in their areas of activity. In other words, those interviewed perceive that the EU influences their activities, whether in government, business, or the third sector. With the same score, in third place in the ranking is question 3, "How would you rate the EU's influence on trade in forest products in Mato Grosso?" with 60% agreement. It is understood that the scores for this question were high, indicating that, according to the interviewees' perception, the EU influences the trade in forest products in Mato Grosso and the sectors in which it operates. In both instances, whether on the interviewees' activities or the trade in forest products, the EU's influence is perceived as relevant to the exchange between federal and state governments.

Both findings are of great importance to the paper. Although the sampling model is non-probabilistic by judgment, there are indications that the EU influences the state of Mato Grosso in the environmental sector and the trade in forest products, data that has been proven throughout the text with the analysis of the Brussels Effect. This influence is felt for several reasons:

- I. by the export of wood from Mato Grosso to the EU, which of the accumulated FOB value between 2003 and 2021, corresponds to almost 23% of wood exports;
- II. Because of the EU's ability to build regulations with a global impact on the environment,
- III. Because of the strict regulations, such as the EUDR, which have an impact on trade relations;
- IV. they are regulations that must be complied with to enter the European market.

When analyzing these elements from the perspective of the Brussels Effect, four elements are present: market size (I), regulatory capacity (II), strict standards (III), and inelastic targets (IV). Although the interviewees did not perceive the requirement of indivisibility, it does not misconfigure the Brussels Effect.

The results found are based on the findings of Gwiazdowicz and Matulewska [34], as they show that the stakeholders who work and are connected to the forestry trade defend the use of wood for industry, generating jobs and keeping forests standing, after all, one can not confuse the timber trade with illegal deforestation.

8 Analyzing the Timber Producers in Mato Grosso from Export and Labor Data

Applying the method displayed in the the previous sections to Mato Grosso timber production consists of finding the weight of share of each municipality formal timber labor force in terms of the Mato Grosso total and using this share or weight to calculate the timber exports of each municipality in the year considered. In an exploratory analysis, Fig. 1 below shows that 81 municipalities in Mato Grosso exports timber in 2022.

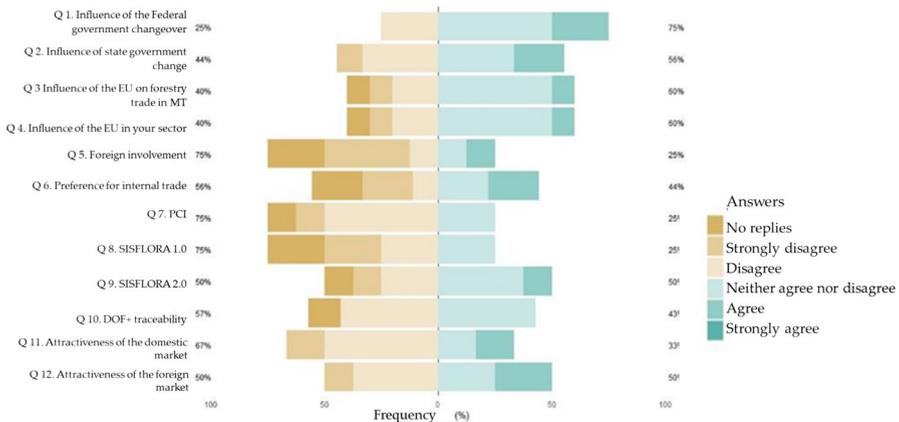


Fig. 1 Likert Scale. Source: Author's production

The highest values of production oriented to exports can be seen from municipalities present in the Amazon rainforest, with few municipalities exporting from the Pantanal and Cerrado.

This analysis is replicated for 2020 and 2021 in the Fig. 2 down below:

From the previous two figures, it is possible to attest the timber trade has been getting more intense in recent years. Moreover, it has been more intense in the Amazon municipalities of Mato Grosso. This can be seen as an indicative that many Mato Grosso municipalities will be exposed to the EUDR once this regulation becomes active in 2025. This exposure, as the maps indicate, will not be limited to few municipalities (Fig. 3).

9 Conclusion

The forestry sector in Mato Grosso is vital to the state's economy, contributing significantly to tax collection and job creation. International demand for native and exotic timber drives this trade, but new regulations and stricter international trade rules impose additional challenges. Promoting Sustainable Forest Management practices and including local communities in production and marketing strengthens socio-economic development and ties between local populations and their environment. Focusing on sustainability and social welfare is fundamental to the continuity of this trade in the state.

The European Union is a crucial trading partner for Mato Grosso and Brazil, especially in the timber sector. The implementation of the EUDR, although aimed at sustainability, brings significant challenges for local producers, increasing costs and bureaucracy. A balance must be found between the EU's sustainability requirements

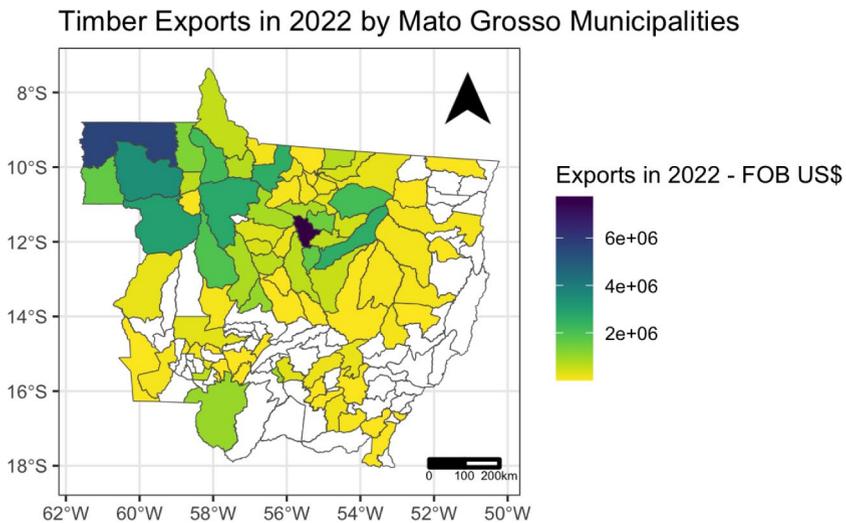


Fig. 2 Timber Exports by Mato Grosso in 2022. *Source:* Author's production

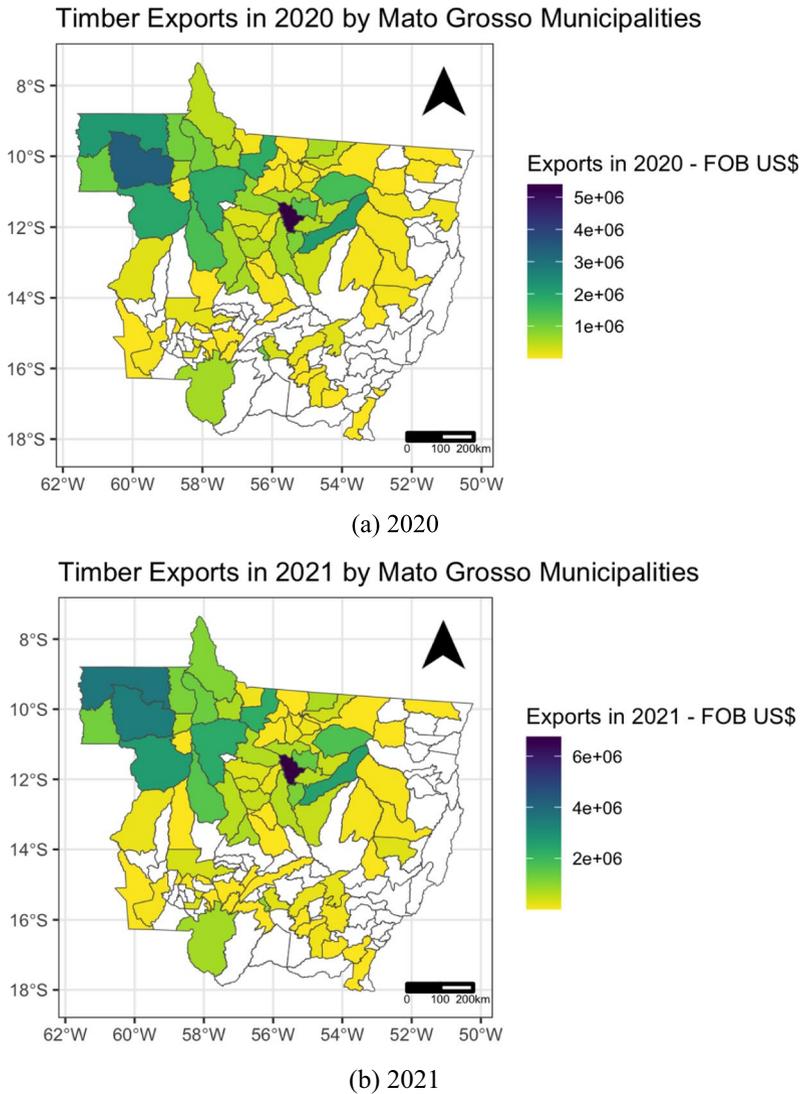


Fig. 3 Timber Exports by Mato Grosso in 2020 and 2021. *Source:* Author's production

and the economic viability of small and medium-sized Brazilian producers. The transition to more sustainable practices must be accompanied by adequate financial and technical support to minimize negative socio-economic impacts. In this way, it is possible to guarantee sustainable trade that benefits both the environment and local communities.

The Brussels Effect stands out as a model of global regulatory influence in which the European Union plays a crucial role in setting international regulatory standards. Thanks to its solid regulatory capacity and firm targets, the EU shapes

global trade and promotes worldwide convergence of standards. This phenomenon not only highlights the influence of the European market but also underlines the importance of institutional capacity and political determination in promoting regulatory change on a global scale, especially in critical sectors such as the environment.

Consequently, EU regulations for the timber trade have extended beyond borders, impacting numerous countries and companies that adjust to the standards set to obtain the necessary certification and access the European timber market.

Analyzing stakeholders' perceptions of the Brussels Effect reveals a complex and multifaceted panorama. The results obtained through the semi-structured interviews highlight the varying awareness of the different groups interviewed in the timber forestry sector in Mato Grosso regarding European regulations. State officials perceive the influence of EU regulations, mainly concerning local public policies and international pressure on deforestation in the Amazon. Concern about regulations' fairness and social impact is evident, reflecting a critical view of external imposition without prior consultation.

Entrepreneurs, in turn, reveal a more direct understanding of the connection between European regulations and the international timber market. They highlight challenges such as the negative perception of Brazilian timber, the need to differentiate between sustainable management and illegal deforestation, and the financial impact of certifications. They recognize the importance of improving relations, creating incentives for sustainable practices, and developing strategies to mitigate the adverse effects of regulations.

The third sector focuses on environmental and market issues, such as deforestation in the Amazon and the public perception of forest management versus deforestation. They point to the need to clarify the positive role of forest management in conservation and sustainability, especially in the context of European requirements.

Stakeholder perceptions reveal a complex intersection between environmental, economic, and social concerns. This highlights the importance of constructive dialogue between the different actors to mitigate conflicts and promote sustainable practices in Mato Grosso's forestry sector. This aligns with global and local demands for environmental conservation and sustainable economic development.

Moreover, the EUDR affects direct and indirect deforestation in different ways. By targeting newly deforested areas, this regulation will likely have a stronger impact on deforestation aimed directly at exporting goods, such as timber. Indirect deforestation, on the other hand, refers to a potential side effect of exporting goods produced on land that has already been deforested, while goods for domestic use may come from newly deforested land, which falls outside the reach of the EUDR. For instance, lands in the Cerrado biome could be used to produce goods directed toward the EU, yet remain outside the scope of the EUDR. Therefore, this could have a significant impact on Brazil's export sectors, particularly in the timber trade. It is suggested that this matter be examined in future studies after the EUDR- comes into force.

Moreover, this paper implements an imputation procedure to analyze more thoroughly the exposition of Mato Grosso municipalities to the EUDR, in terms of timber trade, finding that this regulation should affect this production of more than 80 municipalities. For future research, it is suggested to analyze the regulatory and economic impact after the EUDR actually begins to operate.

Appendix I

01. What influence has the change of federal government had on your area of activity?
02. What influence has the change of state government had on your area of activity?
03. How would you rate the influence of the EU on trade in forestry products in Mato Grosso?
04. How would you rate the EU's influence on your sector?
05. Indicate the extent of foreign involvement in your sector (e.g., number and nationalities of concessionaires/owners of (joint) mills, area of forest allocated, scale of investment, etc.).
06. Judge the following sentence: The bureaucracy for exporting is such that there is a preference for domestic trade.
07. How pleased are you with the Produce, Conserve, Include (PCI) program?
08. How pleased are you with the SISFLORA 1.0 system?
09. How pleased are you with the SISFLORA 2.0 system?
10. How pleased are you with DOF + traceability?
11. How attractive is the internal market?
12. How attractive is the foreign market?

Appendix II

Date and time	Sector of activity	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
8/31/2023 18:00:22	Entrepreneur	3	2	2	2	2	5	1	1	1	1	2	5
8/31/2023 19:01:23	Third sector	4	4	3	3	4	3	3	2	3	3	3	3
9/4/2023 15:08:50	State	0	4	4	3	0	4	0	4	5	0	0	0
9/6/2023 15:42:16	Entrepreneur	5	3	4	4	5	1	3	3	2	3	3	4
9/14/2023 13:50:42	Third sector	4	3	3	4	2	2	0	3	4	4	0	0
9/14/2023 13:53:00	Entrepreneur	4	4	4	4	2	2	4	4	4	4	3	4
9/15/2023 11:37:12	State	4	5	4	4	3	0	4	0	0	0	0	3
9/16/2023 14:22:53	Entrepreneur	5	5	4	4	1	5	3	1	3	3	5	2
9/16/2023 14:27:21	Entrepreneur	3	3	5	5	1	4	3	2	4	4	4	3
9/21/2023 15:52:14	State	0	0	1	1	0	1	2	0	0	0	0	5

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