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DOI: 10.48075/igepec.29i1.34440

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Abstract: *The provision of food, fiber, bioenergy and water is essential to meet the growing global demand, but it faces environmental challenges such as deforestation and habitat loss. Although the new Brazilian Forest Code aims to protect the environment, its effectiveness is limited, especially due to the diversity of biomes. The forest conversion in the Cerrado, particularly in the MATOPIBA region, demands immediate solutions. This research calculates the amount of Payment for Environmental Services (PES) required to encourage producers to adopt protective measures that prevent the conversion of the Legal Reserve Surplus (LRS) in agricultural areas. Using the model of Computable General Equilibrium (CGE) Brazilian Economic Analysis (BREA), two scenarios were simulated: Base and PES (BT). In the Base scenario, 400,000 hectares of LRS would be converted to crop production in the Cerrado biome. In the PES (BT) scenario, the converted area would be 191,000 hectares destined for soybean production and livestock rearing in the same territory. Financially, the soybean production in the PES (BT) scenario would generate R$ 541.2 million, while the production of pastures would reach R$ 2.4 billion. The results provide valuable inputs for public policy formulation, highlighting the importance of balancing agricultural production with environmental conservation in order to meet producers' needs and protect ecosystems.*

Keywords: *Brazilian Center-West, LRS, MATOPIBA, PES.*

Resumo: O fornecimento de alimentos, fibras, bioenergia e água é essencial para atender a crescente demanda global, mas enfrenta desafios ambientais como desmatamento e perda de habitat. Embora o novo Código Florestal tenha como objetivo proteger o meio ambiente, sua eficácia é limitada, principalmente devido à diversidade de biomas. A conversão florestal no Cerrado, particularmente na região do MATOPIBA, exige soluções imediatas. Esta pesquisa calcula o valor do Pagamento por Serviços Ambientais (PSA) necessário para incentivar os produtores a adotarem medidas de proteção que impeçam a conversão do Excedente de Reserva Legal (ERL) em áreas agrícolas. Utilizando o modelo de Equilíbrio Geral Computável (EGC) da Análise Econômica Brasileira (BREA), foram simulados dois cenários: Base e PAS (BT). No cenário base, 400.000 hectares de ERL seriam convertidos para a produção agrícola no bioma do Cerrado. No cenário PAS (BT), a área convertida seria de 191.000

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hectares destinados à produção de soja e criação de gado no mesmo território. Financeiramente, a produção de soja no cenário PAS (BT) geraria R$ 541,2 milhões, enquanto a produção de pastagens atingiria R$ 2,4 bilhões. Os resultados fornecem insumos valiosos para a formulação de políticas públicas, destacando a importância do equilíbrio entre produção agrícola e conservação ambiental, a fim de atender às necessidades dos produtores e proteger os ecossistemas.
Palavras-chave: Centro-Oeste brasileiro, ERL, MATOPIBA, PSA.

***Resumen**: El suministro de alimentos, fibras, bioenergía y agua es esencial para satisfacer la creciente demanda global, pero enfrenta desafíos ambientales como la deforestación y la pérdida de hábitat. Aunque el nuevo Código Forestal tiene como objetivo proteger el medio ambiente, su eficacia es limitada, principalmente debido a la diversidad de los biomos. La conversión forestal en el Cerrado, particularmente en la región de MATOPIBA, requiere soluciones inmediatas. Esta investigación calcula el valor del Pago por Servicios Ambientales (PSA) necesario para incentivar a los productores a adoptar medidas de protección que impidan la conversión del Excedente de Reserva Legal (ERL) en áreas agrícolas. Utilizando el modelo de Equilibrio General Computable (EGC) del Análisis Económico Brasileño (BREA), se simularon dos escenarios: Base y PAS (BT). En el escenario base, 400.000 hectáreas de ERL serían convertidas para la producción agrícola en el bioma del Cerrado. En el escenario PAS (BT), la superficie convertida sería de 191.000 hectáreas destinadas a la producción de soja y ganadería en el mismo territorio. Financieramente, la producción de soja en el escenario PAS (BT) generaría R$ 541,2 millones, mientras que la producción de pastos alcanzaría R$ 2,4 mil millones. Los resultados proporcionan insumos valiosos para la formulación de políticas públicas, destacando la importancia del equilibrio entre producción agrícola y conservación ambiental, con el fin de atender las necesidades de los productores y proteger los ecosistemas.*

***Palabras clave**: Centro-Oeste brasileño, ERL, MATOPIBA, PSA.*

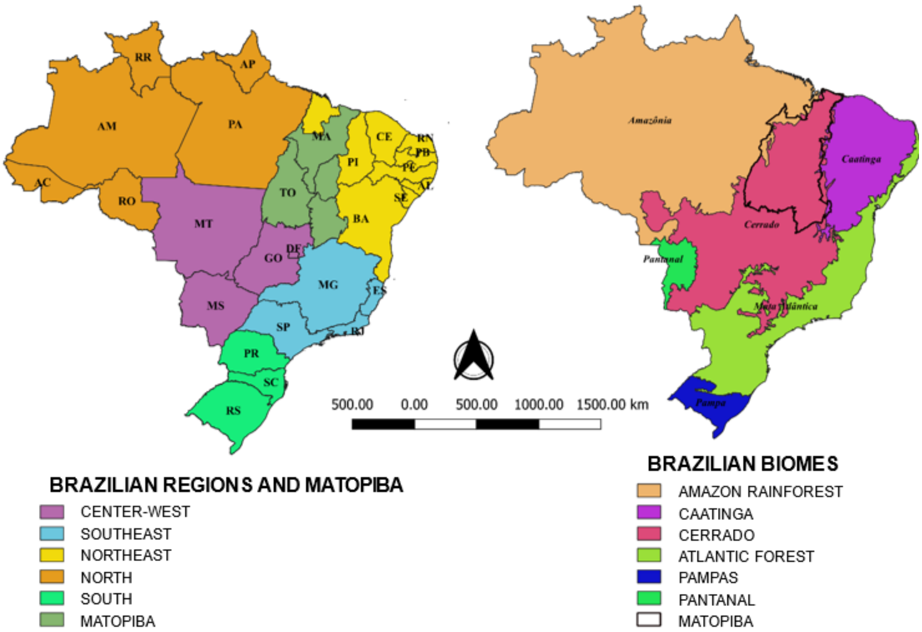
INTRODUCTION

The provision of food, fiber, bioenergy and water is essential to meet the growing global demand. However, this production faces significant environmental challenges such as deforestation, habitat loss, biodiversity impacts and greenhouse gas (GHG) emissions (Sparovek et al., 2018; Xu et al., 2021). In Brazil, one of the largest producers and exporters of commodities in the world, agricultural expansion may further aggravate forest suppression if adequate protection measures are not implemented (Kalamandeen et al., 2018; Suela et al., 2021; Christ et al., 2022 Suela, 2024).

The preservation of native vegetation depends on effective legislation, such as the Brazilian Forest Code (FC), which establishes standards for the protection of vegetation. However, its effectiveness is limited by the diversity of Brazilian biomes (Nepstad et al., 2014; Soterroni et al., 2019; Polizel et al., 2021; Suela et al., 2023). In the *Cerrado*, only 20% of the area is protected, while in the Amazon the legislation requires the conservation of 80% of the vegetation on private lands (BRASIL, 2012). Regulatory measures, such as the Moratorium on Soy in the Amazon (MS), which prohibits the marketing of soybeans from deforested areas and promotes zero deforestation, were not adopted in the *Cerrado* due to lack of political interest (Nepstad et al., 2014; Soterroni et al., 2019; Cabral et al., 2023). An alternative to reduce forest conversion would be to expand agriculture on already deforested land (Soterroni et al., 2019).

The research focuses on the MATOPIBA region (acronym for the *Cerrado* biome areas in the states of *MAranhão*, *TOcantins*, *PIauí* and *BAhia*) (Figure 1), which has shown a significant increase in forest suppression in the last two decades (*Ministério* da *Agricultura*, *Pecuária* e *Abastecimento* - Mapa, 2020; Magalhães et al., 2021). Soybean production in MATOPIBA grew from 5.7 million tons (Mt) in 2008 to 12.8 Mt in 2018/2019, representing 12% of the national crop (*Companhia Nacional de Abastecimento* - *Conab*, 2020).

Figura 1. Map containing the Brazilian biomes as well as the MATOPIBA region explicitly



Source: author's elaboration.

According to the Map (2020), the MATOPIBA agricultural frontier will produce about 32.7 Mt of grain by 2029/30, in an area planted of 8.9 million hectares (Mha) at the end of the projected period. Agricultural expansion in MATOPIBA may intensify the pressure on native vegetation and aggravate environmental degradation (Solidaridad, 2021). Since the MS in the Amazon, the *Cerrado* has become a key area for expansion of soybean production, resulting in deforestation and significant environmental impacts (Solidaridad, 2021; Cabral et al., 2023). The *Cerrado* is now considered a "buffer zone" for the Amazon, requiring more stringent protection measures (Fian, 2018; Mapa, 2020; Magalhães et al., 2020; Cabral et al., 2023).

Despite the goals of reducing deforestation established in the New Forest Code (NFC), Law no 12.651 of 25 May 2012, and in the Conferences of the Parties (COP 15, 21 and 23), MATOPIBA was responsible for 76% of total deforestation of the *Cerrado* between 2015 and 2022 (Brasil, 2012; Solidaridad, 2021; Cabral et al., 2023; Mapbiomas, 2024). Economic activities aimed at agricultural expansion in the region generate negative externalities, which affect human health, the quality of natural resources and the balance of ecosystems (Rippel and Rippel, 2008; Tietenberg, 2018; Suela et al., 2020; De Souza et al., 2023).

In Brazil, there are 101 Mha of Legal Reserve Surplus (LRS), 37 million of them in the *Cerrado*. This surplus represents areas of native vegetation in rural properties that exceed the minimum percentage required by Brazilian legislation, specifically by the Forest Code. However, the non-mandatory preservation of these areas makes them vulnerable to legal deforestation, especially in situations of economic demand (*Brasil*, 2012; Solidaridad, 2021). In MATOPIBA, the LRS is 16.9 Mha, of which 4.6 Mha have agricultural aptitude (Agrosatélite, 2020). The implementation of the Payment for Environmental Services (PES) can promote the intensification of agricultural production and preserve the LRS, contributing to the conservation of the *Cerrado* ecosystem (Solidaridad, 2021).

In 2017, civil society and private actors launched the Manifesto of the *Cerrado* Biome, committing to grow soybeans only in already deforested areas (*Manifesto*, 2017). In 2019, Bill No 4203 was proposed, establishing a ten-year moratorium on deforestation in the *Cerrado* (MC), but large companies in the soybean sector resist this moratorium, leaving the *Cerrado* vulnerable (*Brasil*, 2019). According to Soterroni et al. (2019), the situation of forest conversions in the *Cerrado* requires an immediate solution.

Therefore, this research aims to calculate the total PES required for producers of the *Cerrado* biome, especially in the MATOPIBA region, to accept a forest protection measure that prevents the conversion of LRS into crops such as soybean, corn and pasture. To achieve this objective, the model of computable general equilibrium called Brazilian Economic Analysis (BREA) was used (Lima, 2017). The importance of native forest goes beyond the economic aspect. This research, through the calculation of PES, aims to contribute to studies on environmental externalities and provide a better understanding of the economic use of native forests, helping to solve problems related to forest suppression and corroborating with the possible developments of MC.

2 – CONTEXTUALIZATION

2.1 – Payments for Environmental Services

Since the late 1990s, Payments for Environmental Services (PES) have gained relevance as market tools for environmental protection and have been incorporated into public policies, especially in Latin America (Wunder, 2005; Engel et al., 2008). Emerging as an alternative to traditional regulatory instruments and conservation projects from the 1970s to the 1990s, PESs encourage conservation through financial transfers between social actors, aligning land use with the promotion of natural capital (Pagiola et al., 2002; Pesche et al., 2012). According to Wunder (2005), a PES is a voluntary transaction in which a buyer pays the supplier of an environmental service, conditional on the delivery of that service.

The economic logic of PES aims to make environmental preservation a competitive alternative in relation to more profitable land uses, such as agriculture, compensating rural owners for environmental services that generate indirect benefits, as water regulation and carbon sequestration (Pagiola and Platais, 2006).

There are two main types of PES programmes: those directly funded by service users and those financed by third parties, mainly governments. User-funded programs tend to be more effective, due to the compatibility of interests and closer supervision; while government programs, although covering larger areas, face challenges related to efficiency and political pressure (Pagiola and Platais, 2006; Engel et al., 2008).

In Brazil, the PES was first implemented in 2006 in Extrema/MG, and later expanded to several regions. In 2016, the PES was integrated into the Nationally Determined Contribution (NDC) under the Paris Agreement, committing the country to GHG emission reduction and vegetation restoration targets. Law 14.119/2021 regulated the PES, highlighting its importance for Brazil, which by 2019 managed to reduce its emissions by 17% compared to 2005, although still far from the target of 37% by 2030 (SEEG, 2023; Winkel et al., 2022).

Informe GEPEC, ISSN: 1679-415X, Toledo, v. 29, n.1, p.182-199, jan./jun. 2025.

3 – METHODOLOGY

Computable General Equilibrium Models (CGE) represent the economy at global, national and regional levels, using equations to describe interactions between economic agents such as families, government and productive sector. These models allow simulations of public policies with economic scope, being widely used in studies of climate, agricultural and deforestation reduction policies, since they capture micro and macroeconomic reactions to changes, as technological innovations or variations in consumer preferences (Rutherford and Paltsev, 2000; Rutherford, 2005; Lima and Gurgel, 2018; Stocco et al., 2020).

The BREA model used in this study is static, multiregional and multisectoral, designed to represent the Brazilian economy in six regions: South, Southeast, North, Northeast, Center-West and MATOPIBA, which together make up the area of the Cerrado biome (Figure 2) (Lima, 2017). In the model, final demand covers consumption, investment and public and private spending, guided by the optimization of consumption and production. Consumers seek to maximize utility under budgetary constraints, generating demand functions that depend on relative prices. BREA was developed in the Mathematical Programming System for General Equilibrium (MPSGE) programming language, using the GTAPinGAMS framework (Rutherford and Paltsev, 2000; Rutherford, 2005; Lima, 2017).

Figure 2. Regional aggregation of Brazil in the BREA model

Fonte: Adapted from Lima (2017)

BREA databases include economic and land use information from various sources. Data from the *Instituto Brasileiro de Geografia e Estatística* (IBGE, 2020b) provide information on agricultural production and state GDP from 2009 to 2019, while data on the quality of grassland (degraded, intermediate and intact) cover the years 2009, 2010, 2019 and 2020 (*Laboratório de Processamento de Imagens e Geoprocessamento* - LAPIG, 2024) The New York Times. The BREA model also incorporates land use maps, including legal reserves, conservation units, cultivated areas and planted forests, allowing for a comprehensive analysis of costs and productivity of land use conversions (Guilhoto et al., 2010; Lima, 2017).

These data are organized in two modules: the economic module, which uses National Accounts and an input-output table according to Guilhoto et al. (2010), and the land use module, detailed in 36 sectors and three production factors - capital, labor and land. Land use segmentation, including cultivation areas, pastures, preservation and infrastructure, is essential for detailed predictive analyses (see Table 1).

Table 1 – Regions, sectors, primary and land use categories

REGIONS		**SECTORS**		**PRIMARY FACTOR INPUTS**	
South	STH	Mineral Iron	MIN	Capital	CAP
Southeast	SST	Coal	COAL	Labor	LAB
Center-West	CST	Mineral Estraction	NMM	Land	LND
North	NTH	Meats	MEAT	*Cropland*	*CROP*
Northeast	NST	Soy Oil	OSD	*Pasture*	*PAST*
Northeast Cerrado (MATOPIBA)	NSTC	Foods	FOOD	*Degraded Pasture*	*DPAS*
		Têxtil and Wood	TEX	*Planted Forest*	*PFOR*
		Refined Oil	ROIL	*Legal Reserve Surplus*	*LRS*
SECTORS		Ethanol	ETH	*Unused Land*	*UNU**
Rice	RICE	Chemistry	CHM		
Meize	CORN	Fertilizer	FERT		
Caner	CANE	Defensives	DFN		
Soy	SOY	Steel Metal non-metalic	MMI		
Fruit	FRIT	Machines	MAC		
Other Cultures	OCUL	Other Industry	OIND		
Forestry	FRST	Electricity	ELEC		
Cattle	CTTL	Pipe gas	PGAS		
Other Live Animals	OLA	Water	WTR		
Swine	SWIN	Public Service	PSRV		
Poultry	PTRY	Construction	CONS		
Milk	MILK	Services	SERV		
Oil	OIL	Transportation	TRNS		
Gas	GAS				

Note: (*) (Legally protected units) UNU: Legal Reserve; Conservation Units; Planted Forests; Indigenous Lands; Military Areas; *Quilombola* Areas; Public Non-designated Areas; Infrastructure and Rivers.
Source: author's elaboration

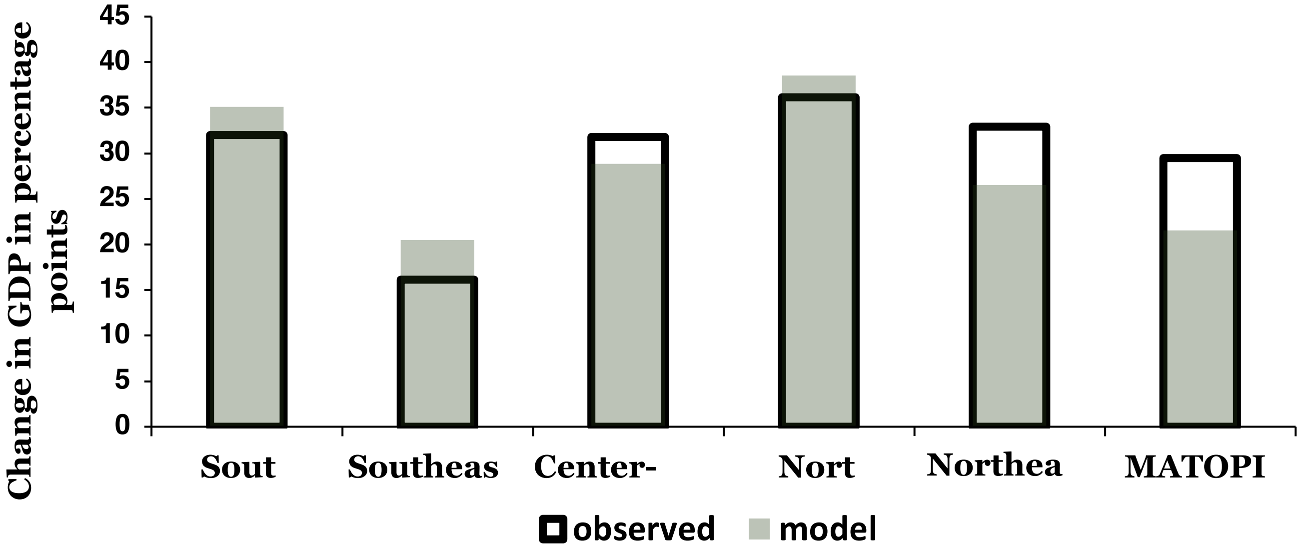
To ensure the accuracy of results, data were reviewed and integrated from reliable sources such as IBGE, *Instituto Nacional de Pesquisas Espaciais* (INPE), *Ministério do Meio Ambiente* (MMA), MAPA, CONAB and SOS *Mata Atlântica*, addressing aspects such as degradation of pastures and LRS. BREA adopts a market approach with flexible prices, without considering unemployment, maintaining fixed investments and capital flows as well as the balance of payments. Changes in prices, activity levels and consumption affect government consumption and tax collection. With this comprehensive framework, BREA is a useful tool for projecting economic and environmental impacts of policies such as the application of PES, providing a solid basis for decision-making.

3.1– Historical validation in the BREA model

The historical validation of BREA consists in comparing the model's predictions with real data, a common practice in general equilibrium models. This allows to evaluate the accuracy of the model in replicating short and long-term economic patterns in Brazil, using data from 2009 to 2020 on land use, GDP and agricultural production. The initial 2019 calibration was adjusted with fundamental parameters and variables, ensuring that the model accurately reflected the economic conditions of the period analyzed (Rutherford; Paltsev, 2000; Rutherford, 2005; Guilhoto et al., 2010).

Figure 3 shows that the model has adequate precision in broad regions, such as South, Southeast and Center-West, with error variations between -2 and 4 percentage points. However, less aggregated regions such as the Northeast and MATOPIBA show higher discrepancies, with variations of up to 7 percentage points. These differences reflect the challenges of projections in highly disaggregated databases. The model has shown good performance in historical validation until 2020, but its reliability decreases in projections beyond 2030, highlighting limitations for long-term forecasts.

Figure 3– BREA model calibration for the year 2019



3.2 – Simulated scenarios

The simulations were performed in two scenarios: the Base scenario (referential) and the PES scenario (BT), which includes the analysis of the Payment for Environmental Services. The BREA model, as described above, was calibrated with 2009 data, followed by projections until 2019 and a shock for the period from 2019 to 2030, evaluating economic impacts related to the partial use of LRS.

- **Base scenario (reference or baseline):** Represents a business-as-usual trajectory, with expectations for economic variables such as GDP, investment, consumption and exports. In this scenario, there is no restriction for conversion of native vegetation (LRS and UNU) into other uses, allowing the full use of these areas.
- **PES (BT) scenario for Production of Soybean, Corn and Pastures in LRS Areas:** In this scenario, the amount of new soybean, corn and pastures production areas in LRS areas is simulated. The objective is to evaluate the volume of forest areas converted for these crops by 2030.

The "Base Scenario" serves as a reference for projecting economic variables until 2030, considering the integral use of LRS and UNUs (legally protected units). The PES (BT) scenario focuses on specific PES policies for crops such as soybeans, corn and pastures, imposing restrictions on forest use through shocks in the BREA model. These shocks include policies to limit deforestation and forest regulations, allowing the impact on agricultural production, land use, deforestation rates and economic indicators to be assessed.

In the macroeconomic closing of the CGE model, the supply of productive factors is fixed, without capital mobility and labor between regions. Land is exclusive to the agricultural sectors and, like other factors, it has no mobility. The model does not consider unemployment and uses flexible prices. Investments and the balance of payments remain fixed, while adjustments in the real exchange rate accommodate changes in exports and imports, with government expenditure reacting to variations in prices and tax revenues. These assumptions shape land use projections that, although detailed, may not accurately reflect all the regional trends observed in Brazil (Rutherford; Paltsev, 2000; Rutherford, 2005).

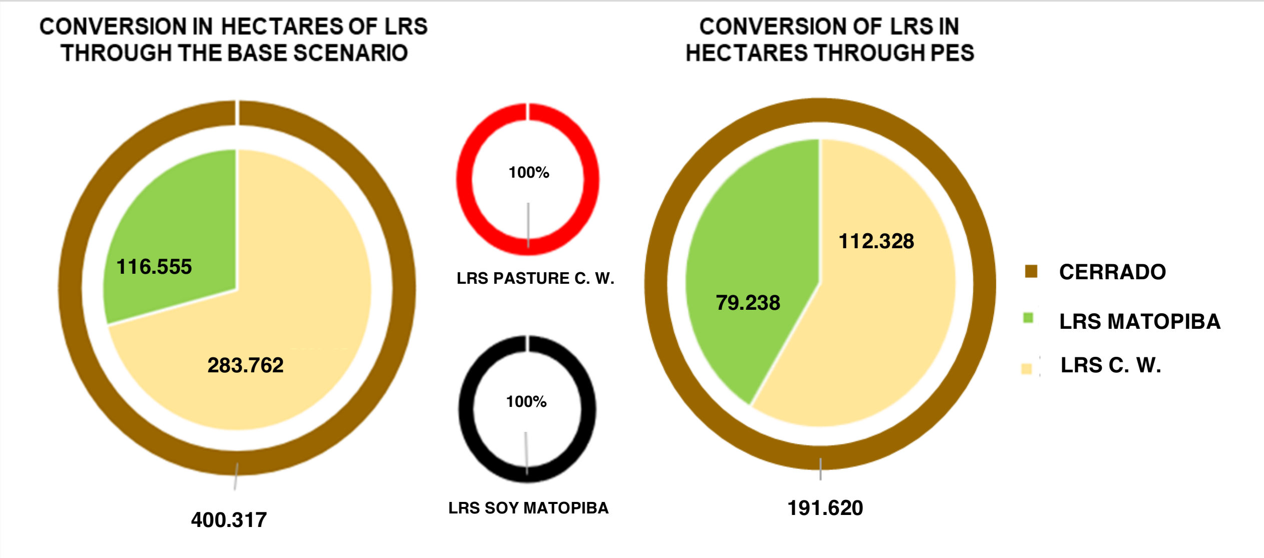
4 – RESULTS

A detailed representation of land use in CGE Models allows investigating how economic activities impact the environment, since natural areas including forests and non-forest lands are included in the database. Land use changes are driven by factors such as demand for food, fuel and fiber, need for environmental conservation and agricultural suitability of the areas. Thus, it was analyzed the value of PES necessary to make producers indifferent to the conversion of their areas of LRS, establishing an economic value that considers the production costs and that can support the Law 14.119 of 2021, that regulates PES in Brazil (Winkel et al., 2022).

To simulate the value of PES at national level, a scenario focused on the conversion of LRS areas for agricultural production was developed, called PES Scenario (BT). This scenario aims to avoid the conversion of areas of legally protected units (UNU) and allows the conversion only of the LRS. The costs of forest land acquisition and its transformation into agricultural crops were considered, detailed in Appendix A. The research focused on the conversion of LRS to soybean, corn and pasture due to high levels of deforestation in the *Cerrado* biome (Nepstad et al., 2019; Magalhães et al., 2020) and the actions of the MS, which aims to prevent soybean production in deforested areas from 2020 (*Brasil*, 2019). The inclusion of corn occurred by the crop and crop system, but there was no conversion of LRS to corn. The choice of pastures is due to the possibility of expansion of barriers against beef production, as already happens in the North region due to MS in the Amazon.

Figure 5 illustrates the total LRS converted for soybean and pasture production in the *Cerrado* biome (Center-West and MATOPIBA), in the Base and PES (BT) scenarios. The data include soybean and grassland areas in the *Cerrado*, allowing to observe the difference in the area converted between crops. In the Base Scenario, without protective measures, approximately 400,000 hectares of LRS would be converted, resulting in less incentive for pro-environmental actions and greater conversion of LRS to soybean and pasture production in 2030. In the PES (BT) scenario, which restricts conversion only to soybean, corn and pasture, the converted area would be approximately 191,000 hectares by 2030, a reduction of 52% due to deforestation restrictions.

Figure 5 – LRS conversion for PES (BT) and Base

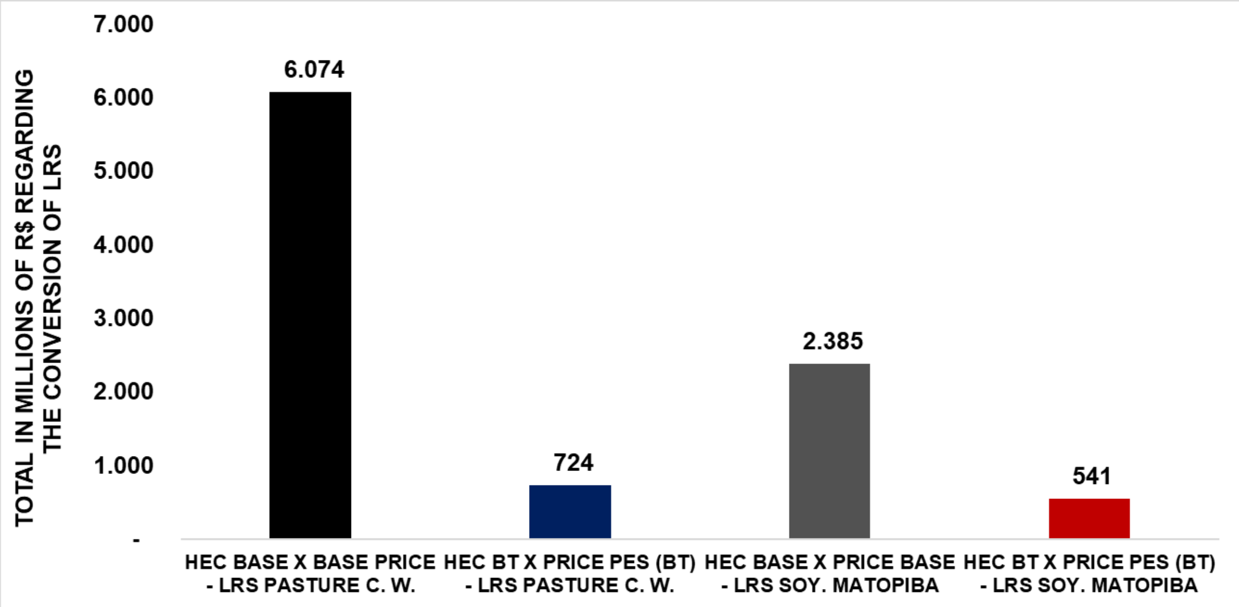


Source: author's elaboration

Figure 5 also indicates that the largest forest conversion in the *Cerrado* occurs for pasture production in both scenarios. This result suggests that the Center-West would tend to specialize in animal protein production by 2030, focusing on converting LRS to new grazing areas. On the other hand, MATOPIBA would continue converting LRS to soybean production, maintaining its growth and specialization in this crop. This result supports the idea that, with the development of the agricultural area of the *Cerrado*, MATOPIBA would specialize in soybean production, reinforcing the importance of MC to avoid new forest conversions for this crop (*Brasil*, 2019; Soterroni et al., 2019).

For the financial analysis of PES, the research considered the PES (BT) and Base scenarios, focused on the conversion of LRS to soybean, corn and pasture. It should be noted that the model did not identify conversion of new areas for corn production. Figure 6 shows the values obtained by producers in 2030 with the marketing of soybeans or cattle, considering both scenarios. In the PES (BT) scenario, soybean production in the *Cerrado* would yield approximately R$ 541.2 million in an area of 79,000 hectares, with emphasis on MATOPIBA. This value reinforces the relevance of the region for soybean production and its impact on Brazilian GDP. In the case of pastures, the model simulated approximately R$ 2.4 billion in an area of 112 thousand hectares.

Figure 6 – Total PES values that could make producers indifferent about whether or not to convert their LRS areas in the Base and PES (BT) scenarios

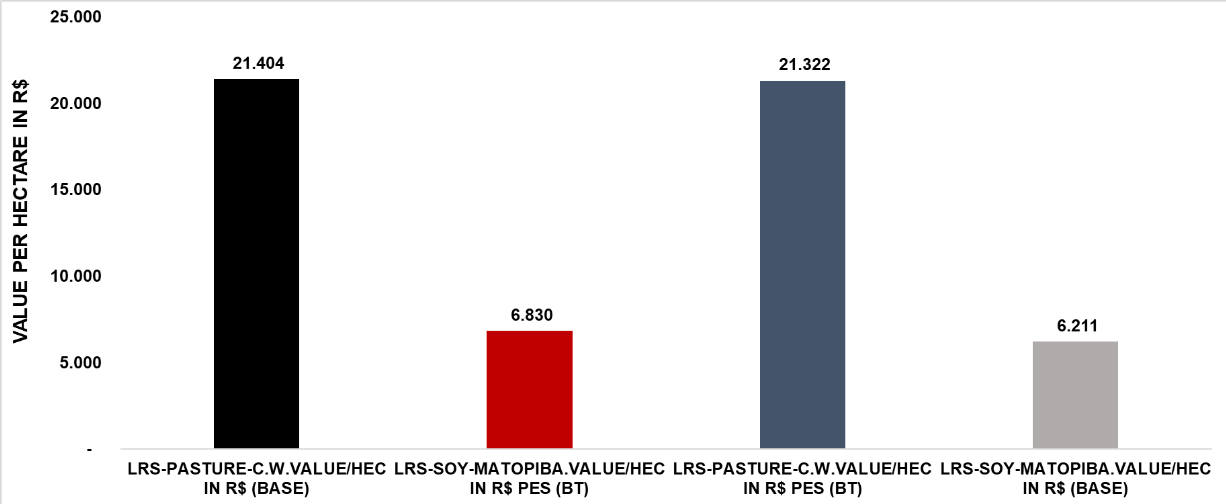


Source: author's elaboration

In the Base Scenario, soybean production in the *Cerrado* would reach about R$ 724 million, in an area of 116.5 thousand hectares, while the production of pastures would generate approximately R$ 6 billion in an area of about 283 thousand hectares, as illustrated in Figure 6. These values highlight the importance of livestock production in the Brazilian agricultural and economic context, demonstrating the potential of pasturage as a significant source of revenue for producers in both scenarios.

Figure 7 shows the annual values in reais per hectare (R$/ha/year) that producers would obtain in 2030 in the Center-West and MATOPIBA regions, considering soybean crops and pastures separately, in the PES (BT) and Base scenarios. It is observed that soybean production in the Center-West is limited in both scenarios, while in MATOPIBA the conversion of LRS to pasture production is non-existent.

Figure 7 – Value gained per hectare of soybean and pasture in 2030 for the Base and PES (BT) scenarios



Source: author's elaboration

In Figure 7, we can see that the values vary between cultures and scenarios. In MATOPIBA, if the PES (BT) scenario were implemented, producers would receive about 10% more than in the Base Scenario, indicating that more profitable alternatives and more robust pro-environmental policies could favor environmental conservation. In the case of pastures, produced exclusively in the Center-West, the values for both scenarios are close: the Base Scenario presented R$ 21,404.00/ha/year, while the PES (BT) presented R$ 21,322.00/ha/year, a difference of only 0.4%.

Although soybean production in MATOPIBA shows a pro-environmental incentive in the PES scenario, it does not occur for grasslands in the Center-West. However, the adoption of the PES Scenario (BT) would indicate that with minimal financial impact, producers could be motivated to conserve forests. In addition, the success of PES actions requires government support not only financial, but also public policies that integrate rural extension practices, reinforcing the importance of preservation.

FINAL CONSIDERATIONS

This study addressed, based on theoretical arguments, the problem of forest conversion in the *Cerrado*, with emphasis on the agricultural border region of MATOPIBA. Using the Computable General Equilibrium (CGE) model, BREA, which offers a detailed representation of the agricultural sectors and several categories of land use, the study based on the both in economic theories and qualitative contributions on preferences and possibilities of public policies.

The main objective was to quantify a mechanism of Payment for Environmental Services (PES) in the Legal Reserve Surplus (LRS) in the *Cerrado*, with special attention to the region of MATOPIBA until 2030. The integrated approach, combining economic theory, detailed sectoral representation and environmental policy considerations, aims to understand and address the challenges related to environmental preservation and economic development in agricultural frontier areas. It is important to highlight that the research question that guided this study reflects a concern with the Moratorium on Soybean in the *Cerrado* (MC), which may have an impact in the near future.

In this context, initiatives such as the Low Carbon Agriculture Plan (ABC Plan), the Deforestation and Forest Degradation Emissions Reduction (REDD) program and Law 14.119 of 2021, which establishes the guidelines for the PES, have the potential to support producers who still maintain forest areas on their properties. This research simulated the PES values needed to make land owners indifferent between converting or not their native forest areas, composed by LRS, in the *Cerrado* biome.

In the PES (BT) scenario, the values of PES in the *Cerrado* varied between R$ 6,830.00/ha/year and R$ 21,404.00/ha/year for soybean production and pasture, respectively. The representative agents of the Center-West would not convert native forests to soybean production; however, this conversion would occur in MATOPIBA. For MATOPIBA, the model simulated a value of R$ 6,830.00/ha/year, which would be necessary to make producers indifferent to the conversion of LRS in new productive areas. In relation to the production of pastures, there was no forest conversion for this purpose in MATOPIBA, but in the Center-West, where the value of PES necessary for the owner to become indifferent was R$ 21,322.00/ ha/ year.

It is important to emphasize that these values represent an alternative that can be used as a reference by decision makers in future public policies. The trade-off between increasing agricultural production and avoiding conversion of new areas of native forest should consider the needs of rural producers. This research addressed this complex issue in an introductory way, hoping that its contributions can bring positive impacts. However, there are still many open questions that require attention and continued efforts to advance forest protection issues.

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Recebido em 15/11/2024.
Aceito em 30/04/2025.