RBGDR

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ABSTRACT

The aim of this paper is to discuss environmental legislation and its reflection on land use in Brazil and Germany. To fulfill the objective raised, a bibliographic and documentary study was carried out, seeking to understand both territories. In the analysis, the comparative method was used, which allows parallels to be established between the two countries to analyze the differences and similarities. For this purpose, it was compared to the environmental legal framework incident in each selected region. Land use between Brazil and the European Union, the State of Paraná and Germany and the Western Mesoregion of Paraná and Nordrhein-Westfalen State were also investigated. To compare the respective territories, land use was divided into dimensions. The first dimension comprised the areas of forest reserves and the second dimension comprised the areas of agricultural production. The third encompassed the other areas, such as: urban, unused, among others. As main results, it was observed that in Germany there was a rupture between the duality of agricultural production and environmental protection, which did not occur for Brazil. On the environmental legal arrangement, there is greater agricultural land use for EU regions, as well as smaller areas of forest reserves, mainly native. There is also a trend of higher percentage of land use due to agriculture in regions specialized in cereal production. Therefore, it was contacted that environmental legislation exerts direct influence on the agricultural policy in force in Germany and indirect in Brazilian politics.

Keywords: Western Mesoregion; *Nordrhein-Westfalen*; environmental legislation.

RESUMO

O artigo possui o objetivo discutir a legislação ambiental e seu reflexo no uso do solo no Brasil e Alemanha. Para cumprir o objetivo levantado foi feito estudo bibliográfico e documental, buscando compreender ambos os territórios. Na análise utilizou-se o método comparativo, que permite estabelecer paralelos entre os dois países para analisar as diferenças e semelhanças. Para tanto, foi comparado a marco legal ambiental incidente em cada região selecionada. Também foi investigado o uso do solo entre o Brasil e União Europeia, o Estado do Paraná e Alemanha e a Mesorregião Oeste do Paraná e Estado de *Nordrhein-Westfalen*. Para comparar os respectivos territórios o uso do solo foi dividido em dimensões. A primeira dimensão compreendeu as áreas de reservas florestais e a segunda as áreas de produção agropecuária. A terceira englobou as demais áreas, como: urbanas, não usadas, entre outras. Como principais resultados observou-se que na Alemanha houve um rompimento entre a dualidade produção agrícola e proteção ambiental o que não ocorreu para o Brasil. Sobre o arranjo legal ambiental destaca-se um maior uso agrícola do solo para regiões da UE, bem como menores áreas de reservas florestais, principalmente nativas. Também se destaca uma tendência de maior percentual de uso do solo em função da agricultura em regiões especializadas na produção de cereais. Logo, constatou-se que a legislação ambiental exerce influência direta na política agrícola vigente na Alemanha e indireta na política brasileira.

Palavras-Chave: Mesorregião Oeste; *Nordrhein-Westfalen;* legislação ambiental.

INTRODUCTION

Agriculture plays a fundamental role in society, both in developed and developing economies. In Brazil, agriculture has fulfilled its basic functions, being strongly linked to economic dynamics and food security. In the European Union (EU), agriculture has played a prominent role and, after World War II, the member countries have been involved in the formulation of a Common Agricultural Policy (CAP), which was mainly based on providing food security within their territory.

From the discussion initiated in the so-called Club of Rome (Meadows, 1972), through Agenda 21 and the Intergovernmental Panel on Climate Change (IPCC), the international political debate on the environmental issue has intensified (Mota *et. al*, 2008). This debate increasingly has direct repercussions on legal changes in countries and economic blocs, aiming at the conservation of natural resources and the reduction of pollutant emissions.

It is in this context that the environmental legislation of the European Union and Brazil has been modified over time. When such modifications are studied, it becomes apparent that environmental legislation has affected the development and rural territorial occupation both in

the European Union and in Brazil, but as different legislations, with similar objectives, reflect in totally antagonistic realities.

That said, the objective of this article is to discuss environmental legislation and its impact on land use in the territories of Brazil (focus on the State of Paraná), European Union, Germany (focus on the State of *Nordrhein-Westfalen*). In order to fulfill the objective raised, a bibliographic and documentary study was carried out, seeking to understand both territories. In the analysis, the comparative method was used, which allows the establishment of parallels between the two countries to analyze the differences and similarities. According to Silveira (2003), the comparative method is based on the search for the identification of concomitant variations, which makes it possible to relate them to the existing knowledge of the researched theme.

To compare the respective territories, land use was divided into different dimensions. The first dimension is related to the areas of forest reserves and the second reflects the areas of agricultural production. The other dimensions are related to urban areas, unused, grassland vegetation, among others.

To structure the ideas, the article was divided into five topics. The next topic discusses the theoretical foundation of the work. In the third and fourth topics, the environmental legal framework in Brazil and its effects on the national territory are discussed, as well as the various legislations regarding environmental protection in the European Union and Germany. Subsequently, in the results and discussions, a comparative analysis of the dimensions and impacts of the legislation is made. Finally, the final considerations conclude the work.

THEORETICAL BASIS

Macroeconomic policies directly influence the development of Brazilian agriculture, as well as agriculture in the European Union. For example, in the case of environmental policy, a political problem may manifest itself on a local scale but be decided on a global scale. This highlights the importance of macroeconomic policy and how it influences agents, such as farmers and the territory.

Macroeconomic policies are correlated to a country's institutional environment, and that each country's institutions influence the development process. It can be seen that the way in which certain public policies are disseminated in the economy depends on the current institutional

framework, generating impacts on the economic environment and on the use of natural resources (North, 1994).

The so-called "Old Institutionalists", such as Thorstein Veblen, John Commons and Wesley Mitchel, were the main authors of this theoretical current, focusing the analysis on the importance of institutions in the economic system. The analysis carried out by these authors is based on the discussion of how the process of change occurs in the economy, refuting the stability of the system presupposed by classical economic theory (Conceição, 2007).

Thus, in Veblen's conception, habits are based on the instinctive behavior of man as an individual. These instincts are transmitted hereditary, being of fundamental importance for their survival and part of an evolutionary process. In this approach, men create institutions as a means to fulfill a purpose, guided by their instincts (Cavalieri, 2013). Veblen, in his system of analysis, begins to contemplate the institution as an analytical unit in the economy, deriving it from the habits and actions of the collective (routines). In this way, these classical authors of institutionalism modified the focus on maximizing individual utility present in classical theory (Conceição, 2007).

As a result of historical advancement, the "Old" Institutionalism of Veblen, Commons, and Mitchel fostered a generation of thinkers based on their ideas. This prolific generation of researchers can be identified in two main strands: the Neo-institutionalists and the New Institutional Economics (NEI) (Conceição, 2007).

Regarding the theoretical framework of the NEI, it is known that it began in 1937 with the seminal paper of Coase (1993). The main issue addressed by the author was linked to the fundamentals of classical microeconomics. This author questions the effectiveness of the functioning of the price system in the efficient allocation of goods and services by firms, guided by profit maximization. His criticism lies in the fact that firms would incur costs to use the pricing system. Therefore, depending on the costs, firms would resort to contracts as a way to minimize them.

According to Coase (1993), the organization of the firm (microeconomic organization) would be subject to the costs of its transactions, with the motivation of reducing these costs. Therefore, for the author, firms, as an analytical unit, can be seen as a nexus of contracts that behave to minimize the costs of their transactions, opting for contractual relations when the cost of using the market

price system is greater than the costs of the contractual mechanism.

Subsequently, Williamson (1975; 1985) took up the ideas of Coase (1993), addressing the classification of contractual relations exercised by firms. To this end, the author defines the attributes that influence these transactions in three: frequency, uncertainty and specificity of the assets[1]. And depending on the variation of these attributes in the transactions, a governance structure is presented in order to classify the behavior of the firms.

Williamson (1975; 1985) highlights the typology of governance structures in transactions, which can occur via the market, via contract and via hierarchization (verticalization). Based on the typology, the firm would adopt a certain governance structure relativizing the cost present in each attribute. So, on the one hand, the more frequent the transaction, the lower its transactional costs via the market would be. On the other hand, the more specific the traded asset, the greater the advantage in hierarchizing it.

According to Rocha Júnior (2004), the NEI aims to study the relations between institutions and their efficiency and is divided into two main approaches to the hospital. The first addresses governance structures with a focus on transactions and how this is reflected in the coordination of the action of economic agents, thus having a theoretical approach structured in the microeconomic field. The second is related to the institutional environment, investigating the reflection of the effects of changes in institutions on the economy and the formation of institutions themselves.

In this sense, it can be understood that the existing institutions in each country or territory delimit the "rules of the game" for economic agents. Organizations, on the other hand, represent the "players", which are the groups of individuals dedicated to any activity performed for a certain purpose. Institutions limit the scenarios by constituting a set of opportunities in the economy, which, in turn, defines the types of organizations that will be created, as these will be based on institutional limits (North, 1994).

1 Frequency is relative to the amount that the same transaction occurs between certain agents, and the higher the frequency of the transaction, the lower the costs of performing it. Uncertainty is related to future uncertainty when carrying out a certain transaction and is directly linked to limited rationality and opportunism. Asset specificity refers to how much the asset can be reused without loss, the higher its specificity, the greater the complexity and costs involved in carrying out the transaction, and greater losses may occur the more specific the assets transacted.

Based on these ideas, it is observed that environmental policies represent part of the "rules of the game", which influence the development of the two regions studied. In the case of Germany, the current environmental legislation is influenced by the European Agricultural Policy (CAP), which is the result of a collective construction of the EU itself after the Second World War (Pintor; Piacenti, 2021). For Brazil, on the other hand, the delimitations of environmental legislation were determined by the State at the federal level.

ENVIRONMENTAL LEGAL FRAMEWORK IN BRAZIL

In the Brazilian case, Law No. 12,651 of 2012 is the current legal framework that regulates the protection of native vegetation in Brazil. It repealed old legislation (Law 4,771 of 1965 and 7,754 of 1989, and Provisional Measure No. 2,166-67 of 2001) and amended others (Law 6,938 of 1981, 9,393 of 1996 and 11,428 of 2006) to reform and unify environmental legislation in Brazil.

Law 12,651 of 2012 established the legal arrangement that any and all economic or social agents that use soil exploration must comply with. According to its article 1, the law addresses the general rules on: the protection of vegetation, the Permanent Preservation Areas (APP), the Legal Reserve Areas (ARL), forest exploitation, the supply of forest raw material, the control of the origin of forest products and the control and prevention of forest fires (Brazil, 2012).

To classify and delimit the regions and areas to be preserved, this legislation consolidated important concepts, which were essential in the process of standardizing the rules of preservation and land use for Brazil. Among them, the definition of Permanent Preservation Areas (APP), Legal Reserve Areas (ARL) and Legal Amazon area guide preservation measures in the Brazilian territory.

Based on the concept of Permanent Preservation Areas (PPAs), the parameters of measures for the PPAs were defined, which focus on the marginal areas of watercourses, springs and lakes, varying according to the size of the rural properties and the width of the water flow. PPAs can range from five to five hundred meters from the edge of watercourses. These areas are intended exclusively for the preservation of biodiversity, and economic exploitation is prohibited, except for extractive activities, which must respect the periods allowed for collection, according to articles 20 to 22 (Brazil, 2012). Table 1 summarizes the information on the various measures prescribed for APPs.

Table 1 | Variation of reserve conservation footage for APPs around rivers, springs, and lakes

Watercourse width (meters)	Minimum width of the general APP	Minimum width of the APP, depending on the size of the rural property, according to law 12.651/2012			
		Up to 1 tax module	From 1 to 2 tax modules	Up to 4 tax modules	Greater than 4 M. tax
Up to 10	30	5	8	15	20 to 100
10 to 50	50	5	8	15	20 to 100
50 to 200	100	5	8	15	20 to 100
200 to 600	200	5	8	15	20 to 100
More than 600	500	5	8	15	20 to 100
Springs - radius	50	15	15	15	15
Lagos - up to 20 ha[1].	50	5	8	15	30
Lagos - Greater than 20 ha[1].	100	5	8	15	30

Note: [1] For lakes and natural lagoons in urban areas the range has been reduced to 30 meters.

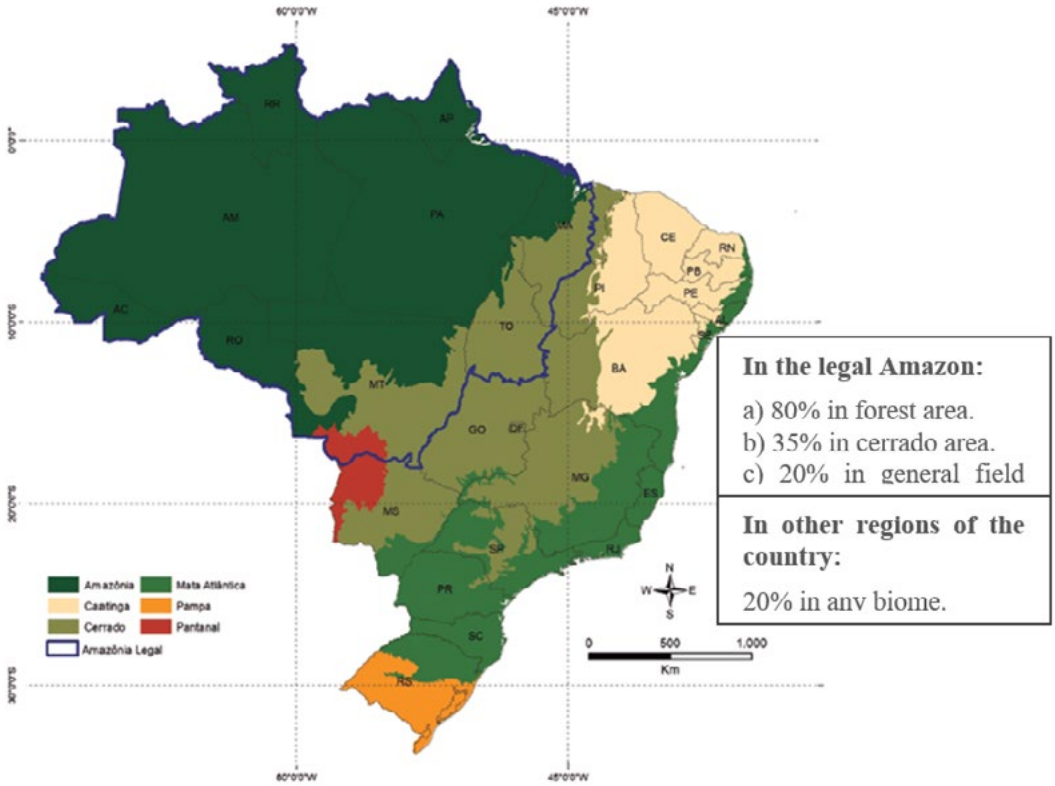
Data source: Brazil, 2012.

So, it is possible to notice that the reserve parameters (APP) vary depending on the type or form of existing watercourse, both in the rural property and in urban areas. Except for exceptions that qualify as duly proven public interest, according to Article 7. Also, in the context of industrial enterprises, the law provides for the need for environmental licenses, which must include the preparation of a specific environmental management plan to be evaluated and approved by a competent governmental environmental agency.

The Legal Reserve Area (ARL) was another important concept defined by the legislation in relation to restrictions on land use and the various types of biomes existing in Brazil. In its article 12, Law 12,651 of 2012 determines that any rural property must maintain a Legal Reserve Area (ARL) according to its location and native vegetation (Brazil, 2012).

For those rural properties located in the Legal Amazon biome, in a forest area, an ARL of 80% of the property must be maintained. On the other hand, the properties located in the cerrado biome, also in the Legal Amazon area, this percentage increases to 35% of the total property. Properties located in areas of general fields or in other states of the federation that do not belong to the Legal Amazon, the percentage of ARL increases to 20% of the property (Brazil, 2012). These areas must be intended for environmental preservation and biodiversity conservation, and their use in agricultural or livestock activities is prohibited. Figure 1 shows the exact biomes and reference areas.

Figure 1 | States, biomes, and the legal Amazon – Brazil 2017



Source: Santos *et al*, 2017.

However, Law 12,651 of 2012, in its article 67, granted exceptions based on the size of the rural property. The legislation established that rural properties that had up to four fiscal modules on July 22, 2008 would not need to recompose the full ARL, only maintain the existing forest area on the property. Therefore, the obligation to recompose the ARL applied to rural properties larger than four fiscal modules (Brazil, 2012).

In Brazil, the fiscal module (MF) is a measurement parameter in hectares, and this measurement varies according to the reference municipality (Santos *et al*., 2017). The MF was created by Law 6.746 of 1979 with the purpose of establishing parameters for the calculation of the Rural Territorial Tax (ITR). For Brazil, the MF can vary from 5 to 110 hectares per fiscal module. For the State of Paraná, the MF varies between 5 and 30 hectares. In the Western Mesoregion of Paraná, it varies from 18 to 20 hectares (IAP, 2018). Table 2 shows the possibilities of variation in the size of rural properties based on the MF and the region.

Table 2 | Variation in rural property size based on fiscal module

Classification	Size of rural property in hectares		
	Brazil	Paraná	West Mesoregion
Up to 1 tax module	5 to 110	5 to 30	18 to 20
Up to 2 tax modules	10 to 220	10 to 60	36 to 40
Up to 4 tax modules	20 to 440	20 to 120	72 to 80
More than 4 tax modules	Over 20 to more than 440	Over 20 to more than 120	Over 72 to over 80

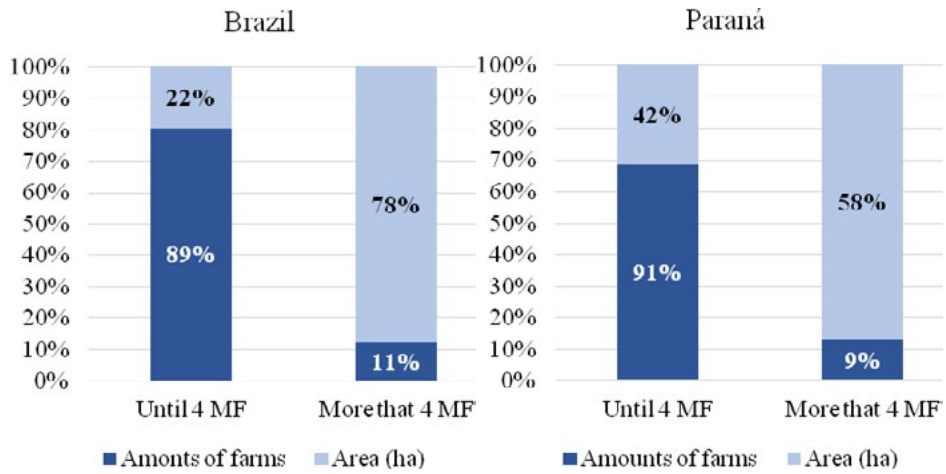
Data source: IAP, 2018; INCRA, 2018.

The MF measure is also relevant to classify rural properties as small, medium and large for Brazil. Law 8.629 of 1993 establishes the fiscal module to specify this classification. This legislation indicates that properties up to 4 MF are considered small, from 4 to 15 MF are medium and larger than 15 MF are considered large properties (Brazil, 1993).

Based on the above, it is possible to perceive the dimension that small rural properties can reach in Brazil. Properties of up to 4 tax modules can reach up to 440 hectares in some municipalities in Brazil. For the State of Paraná this value is reduced to up to 120 hectares and for the Western Mesoregion of Paraná the value for 4 MF reaches up to 80 hectares.

In this sense, it is important to observe the land tenure profile of the region under study, because the larger the properties with more than 4 MF, the greater the area to be reforested. Graph 1 shows information on the size of rural properties classified by fiscal modules for Brazil and the State of Paraná[2], in percentage terms.

Graph 1 | Occupied area and real estate numbers classified by fiscal modules in 2018



Data source: INCRA (2018).

2 Information not available for the Western Mesoregion of Paraná.

Graph 1 shows that for Brazil, rural properties larger than 4 fiscal modules represent 11% of the total properties and 78% of the total agricultural area. In the case of the State of Paraná, these values increase to 9% of the total properties and a total of 58% of the agricultural area of Paraná. It is possible to notice that in Brazil there is a higher concentration of properties larger than 4 MF than in Paraná. Therefore, the impact of the modification of the legislation regarding the ARL to be reforested will be greater for Brazil. Reforestation in Paraná is expected to affect 58% of the current agricultural area, which will only be impacted by those that do not yet have established ARL.

Therefore, it can be inferred that the Brazilian legislation was elaborated with the intention of increasing the areas of biodiversity preservation in a definitive way, as it provides that these areas are maintained as preservation areas, without the possibility of intervention or economic exploitation that cause their mischaracterization. The legislation is imperative, which is mandatory to adhere to and does not provide compensation to rural landowners, who must allocate part of the property to the APP or ARL. Also, no relevant economic incentives resulting from the maintenance of APP and ARL were found in the current agricultural policies.

ENVIRONMENTAL PROTECTION IN THE EU AND GERMANY

In the case of Germany, there is no specific environmental protection law issued by the State, as there is in Brazil. The laws that deal with the subject in the country are divided between the protection and use of forests, the use and protection of the soil and the preservation of water resources. The same occurs for the EU, which has directives on the subject, mainly addressing the integrated planning of actions aimed at the conservation of water resources and natural fauna and flora.

In Germany, the *Bundeswaldgesetz*[3] Act on Forest Conservation and Promotion was enacted in 1975 and was amended on 17 January 2017. In this law, the objectives for forest areas are outlined. The first of these consists of ensuring the sustainable management of these areas by contemplating the following functions: economic (commercial utility), environmental (climate preservation, water balance, air quality) and protective and recreational (soil fertility, landscape, recreation for the population). The second is linked to the promotion of forestry activity. The third expresses the need to strike a balance

3 Translated from the German: *Gesetz zur Erhaltung des Waldes und zur Förderung der Forstwirtschaft (Bundeswaldgesetz).*

between the general interest and the interests of forest owners (BWaldG, 2020b).

The same law defines the classification of forest areas, as well as the possible types of owners. Revealing that the ownership of forest areas can be: state, belonging to the German federation; corporate, belonging to municipalities or associations; and private, those that are not governmental or corporate. Based on the law, it was possible to verify that the State has a central role, being able to exercise it as an actor, conductor and supervisor of the sustainable management of forests in Germany. It was also understood that it is allowed to carry out the management of forest areas, and it is possible to cut and reforest, as long as the legislation of the federated states, which have the ability to legislate on the subject, is observed (BWaldG, 2020b).

In the same vein, the Nature Conservation and Landscape Management Act (BNatSchG)[4] reinforces the importance of nature preservation for the general well-being of inhabitants. In its third article, the same law provides for the possibility of restoration of nature and landscape by the German State, when necessary. In this case, she describes that the mechanisms for operationalizing nature and landscape restoration have public agents as those responsible for the planning and implementation of preservation areas (BWaldG, 2020a).

To this end, plans for the preservation of nature and landscape must be developed and justified according to a range of objectives established by the current legislative apparatus, linked to the conservation of nature and landscape and biodiversity. In addition, plans should have a balance between the proposed results and the impacts of their development (BWaldG, 2020a).

Regarding the BNatSchG Law, it is interesting to note that there is a prescription for the possibility of controlled management of forest areas. In its article 14, the legislation shows that the resumption of land use for agriculture is not considered an intervention, if this area is temporarily used for nature conservation purposes. The minimum time of land use in conservation functions would be 10 years (BWaldG, 2020a). In this way, it can be understood that forest preservation areas can return to cultivation depending on public planning.

Concerning the use of land for agriculture, the same legislation (BNatSchG), in its article 5, portrays the need to reconcile production with the preservation of nature and landscape. It also presents

4 Translated from the German: *Gesetz über Naturschutz und Landschaftspflege (Bundesnaturschutzgesetz - BNatSchG).*

a set of recommendations in order not to harm the environment, such as: ensuring the preservation of sustainable soil fertility; importance of soil cultivation not harming the environment beyond what is necessary to achieve a sustainable yield; the need to preserve specific biotopes; balance between animal husbandry and its environmental effects; the need to maintain meadows near flooded areas, floods, wetlands, among others. In addition, it encourages the use of forestry for the construction of quasi-natural forests through sustainable management (BWaldG, 2020a).

On the other hand, there is also the temporary possibility of framing areas only for the purpose of preservation. The BNatSchG Law has a set of instruments to define and adapt environmental preservation areas, which must be framed as: parks and nature reserves, landscape preservation areas, natural monuments, areas with species and biotopes protected by law. This must occur through due process conducted by the government, respecting the laws and directives on environmental sustainability (BWaldG, 2020a).

Another piece of legislation that addresses environmental issues in Germany is the Law on Protection against Harmful Soil Alteration and Remediation of Contaminated Sites (BBodSchG),[5] which aims to ensure the sustainable use of soil. Article 17 establishes a series of recommendations for good practices in agricultural land use, such as: maintaining soil fertility, maintaining organic matter, preventing soil erosion and compaction, and crop rotation, among others (BWaldG, 2020c). The recommendations are rooted in the objective of avoiding the loss of soil quality, being complementary to agricultural practices. However, the legislation does not present any partial restriction of land use as found in Brazil.

Only the law on the organization of the water balance *(Wasserhaushaltsgesetz - WHG)*[6] has restrictions on land use in areas bordering watercourses. In its article 38, it is regulated that the edges of watercourses must preserve a strip of five meters from the bank, except for exceptions in built areas (urban) and concessions made by local governments, which also have competence in the management of water resources. Therefore, these strips cannot convert the meadows into arable land, and must maintain pasture and arboreal vegetation, and it is possible to manage the latter (BWaldG, 2020d).

5 Translated from the German: *Gesetz zum Schutz vor schädlichen Bodenveränderungen und zur Sanierung von Altlasten (Bundes-Bodenschutzgesetz - BBodSchG).*

6 Translated from the German: *Gesetz zur Ordnung des Wasserhaushalts (Wasserhaushaltsgesetz - WHG).*

According to Gass *et al*. (2016), the same length is adopted by environmental legislation in France. The measure is encouraged by the EU and is linked to CAP subsidies for maintaining good agricultural and environmental conditions, implemented in 2005. However, the author points out that this measure is motivated by the health issue. These areas would have more of a technical function of filtering pollutants to improve water quality than as elements of biodiversity preservation.

About the EU, according to the current treaty, Articles 191 to 193 provide the legal basis for member countries to draw up standards on environmental matters. In the EU, the main directives in force on environmental issues are: Directive 92/43/CEE, which deals with the conservation of natural *habitats* and wild fauna and flora, and Directive 2000/60/CE, which establishes a framework for Community action on policies for the conservation of water resources (Comissão Europeia, 1992; 2000).

Directive 2000/60/EC aims to protect any type of environment involving water resources. To this end, its objectives are linked to the conservation of this resource, improvement in the use of water, prevention of degradation and pollution, preservation of the environment, among others. This directive establishes guidelines on the subject, which member states must observe to develop or adapt their respective standards in order to achieve the planned objectives (Comissão Europeia, 2000).

The directive clarifies that measures for the protection and improvement of water resources must be supported by the EU and conducted through the regional planning of each member state. A series of indicators are established, varying according to the type of aquatic *habitat*, aiming at maintaining and improving water quality. In addition, a periodicity is established for the evaluation of the results (Comissão Europeia, 2000).

Directive 92/43/CEE aims to contribute to ensuring biodiversity through the conservation of natural *habitats*, wild fauna and flora in European territory. It also stresses that it is up to the member states to establish their administrative and legislative measures necessary to meet the proposed objectives. The Member States should also direct efforts to improve the Natura 2000[7] ecological network, which was one of the initiatives created by the directive, aiming to interconnect the preservation areas between the member countries (Comissão Europeia, 2000).

7 It refers to the European ecological network of special areas of preservation. According to Directive 29/43/CE, to maintain the network, it is necessary to ensure that natural *habitat* types and species are restored to a favorable conservation status in their natural range (Comissão Europeia, 1992).

It can therefore be seen that the measures prescribed by the EU directives set a standard of behavior for member states. However, they do not have specific detailed restrictions to meet their objectives. Such measures are the responsibility of the member states and their internal regionalization, which are responsible for creating local standards following EU guidelines. Regarding the incentives to carry out the actions, these were not specifically targeted in the aforementioned directives.

RESULTS AND DISCUSSION

Based on what has been discussed, it was necessary to investigate the effects of environmental legislation on land use in the regions studied. In order to enable an approximate comparative analysis between the different regions, land use was classified in such a way as to show the participation of the areas in forests and those in agricultural use. Due to the temporal specificity of these data, they are presented only for one period, both for the EU (2015) and for the Brazilian (2017) regions.

For Brazil, the data were aggregated into four categories. These are: forest areas, grassy field vegetation areas (savannah, cerrado), agricultural areas and other areas. The inclusion of grassy field vegetation areas (cerrado) was made due to the wide occurrence of this biome in Brazil, as well as its maintenance as a preservation area of native vegetation. Table 3 presents data on land use in Brazil.

Table 3 | Total area and diverse uses Brazil, Paraná and Western Mesoregion in 2017

Territory	Area - (ha)			
	Total[1]	Used agricultural[1]	Forest	Grassy field vegetation[3]
Brazil[3]	851,487,600	236,878,606	380,344,700	118,782,401
Paraná	19,931,500	10,511,805	7,071,882	0
West Mesoregion[2]	2,133,718	1,384,430	545,490	0

Data source: IBGE, 2018[3], 2019a[1]; IPARDES, 2019[2].

Regarding the aggregate data shown in Table 3, it is observed that the agricultural area included, according to the IBGE classification (2019a), the areas of crops, temporary and permanent, planted, degraded and natural pastures and agroforestry systems. The latter was included in the calculation of agricultural area, because despite having part of its area wooded, it is a mixed system where the rural property uses the integration between crops, livestock and planted forests[8] aimed at commercial activity.

8 For a detailed description of the system promoted by Embrapa, see Bungenstab (2012).

To calculate the forest area for Brazil, the areas of natural woods or forest were added with the woods or planted forests (silviculture), according to the IBGE classification (2019a). In addition to these areas, the forest areas surveyed by IBGE (2018) regarding monitoring and land use for Brazil were added[9].

In the case of Paraná and the Western Mesoregion, the areas of native and planted forests, areas of national parks and conservation units, areas of dams, lakes and tanks in indigenous demarcation areas were added[10] (IBGE, 2019a). The areas of national parks in the State of Paraná were used in addition to the survey by the IBGE (2019a), as this survey covers 74% of the total territory of the State, focused on registered rural properties. Therefore, the areas determined by the Brazilian State as preservation areas are excluded from this calculation. According to IAP (2018), Paraná had 68 conservation units managed by the Paraná Environmental Institute, of which 28 were open to visitors.

The areas of grassland vegetation for Brazil include areas of the cerrado (savannah) biome, as well as steppe and grassland vegetation – classified as shrubby, wooded or woody grass (IBGE, 2018). Thus, these areas classified as grassland vegetation consist of undergrowth mixed with small trees, and part of them are permanent reserves of native area.

However, part of these areas are also used for livestock exploration and classified by IBGE (2019a) as natural pasture areas. These natural pastures are areas belonging to the biomes mentioned. They are used in extensive cattle ranching and have low quality for use as commercial pastures, since these areas have low-intensity anthropogenic interference (IBGE, 2018). Therefore, for Brazil, the areas classified as natural pastures (IBGE, 2019a) were subtracted from the area of grassland vegetation. This type of vegetation does not have a relevant incidence in Paraná and the Western Mesoregion.

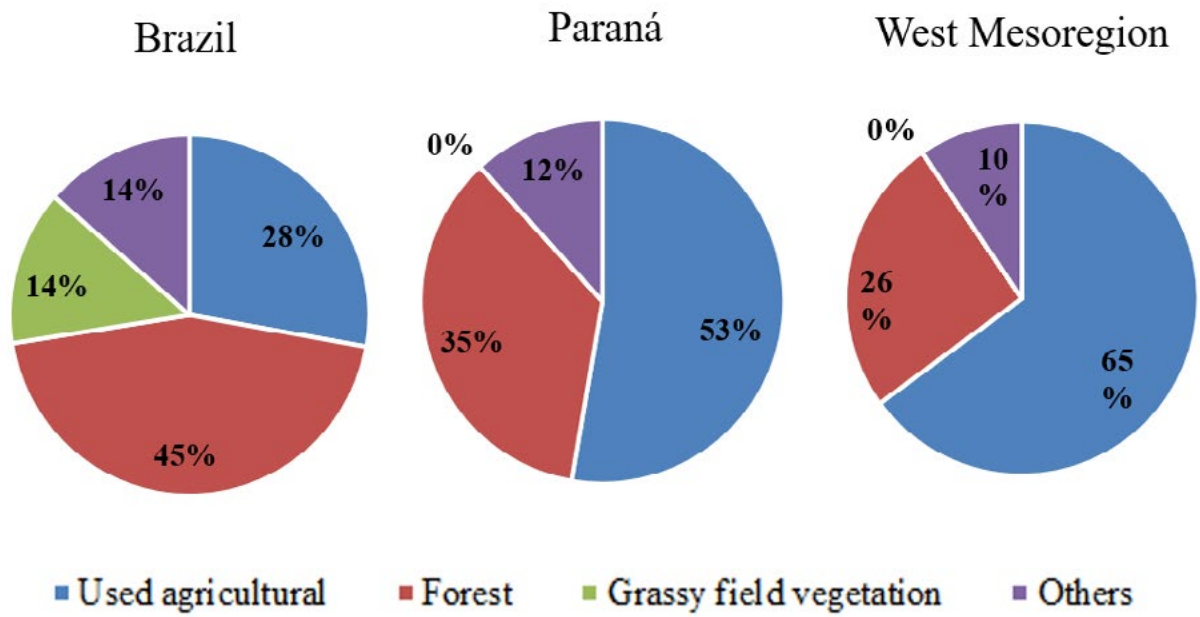
Based on the data obtained in the research, Graph 2 was elaborated, which shows the percentage numbers regarding land use in Brazil, Paraná and the Western Mesoregion. In it, it is possible to see that forest areas in Brazil reach 45% of the national territory, most of which are native forests, as approximately 80% of the Amazon Forest area is still native (IBGE, 2019b). Nevertheless, it should be noted that when considering the areas of cerrado (savannahs), this percentage of reserve in

9 It should be noted that the share of silviculture in the total number of forests in Brazil is only 2% of the forest area.
10 It should be noted that these last two categories do not exceed 4% of the total for each region.

native forests increases to 59% of the entire Brazilian territory, while only 28% of the Brazilian territory is used for the total of agriculture.

Graph 2 also shows that both Paraná and the Western Mesoregion have a smaller area of forests and a larger area used for agriculture. In Paraná this percentage is 53%, while in the Western Mesoregion it is 65%, reaching twice that found for Brazil. On the other hand, the forest area for the Western Mesoregion is 26%, being the lowest percentage found for the Brazilian regions.

Graph 2 | Percentage of land use based on IBGE classification for Brazilian regions in 2017



Data source: IBGE, 2018, 2019a; IPARDES, 2019.

For the EU, Germany and *Nordrhein-Westfalen* (NRW), the classification used was based on the division made by the EU[11], which was aggregated into five categories in order to provide a better comparison of the regions. They were aggregated into forest areas, agricultural areas, residential and service areas, abandoned or unused areas, and other areas. Table 4 presents land use data for the EU, Germany and the State of *Nordrhein-Westfalen* in hectares for the year 2015.

11 This is the definition of forest utilized to Eurostat (2019b): Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy. Cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. In addition, it should be noted that the definition of forest area in the EU also considers areas with permafrost (EEA, 1995).

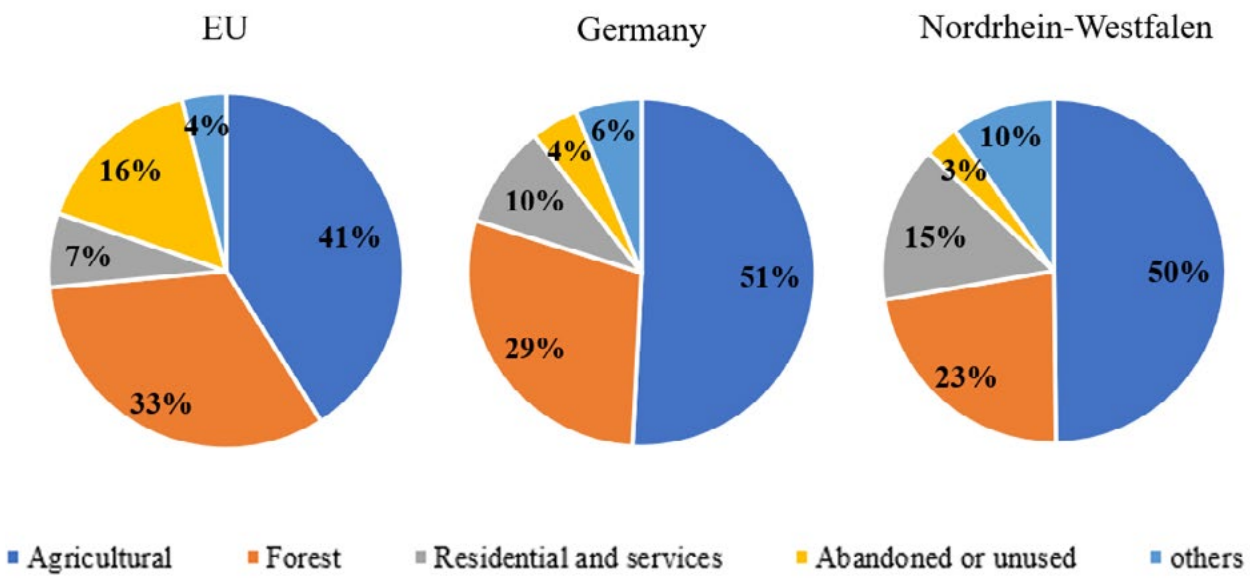
Table 4 | Total area and diverse uses for EU, Germany and State of NRW in 2015

Territory	Areas - (ha)				
	Total	Agricultural Used	Forests	Residential and services	Abandoned or unused
EU	437.942.600	179.646.600	142.369.300	29.452.700	68.843.900
Germany	35.832.700	18.213.900	10.393.900	3.431.000	1.589.100
NRW	3.411.300	1.699.300	767.600	500.900	109.500

Data source: Eurostat, 2019c.

Table 4 shows that agricultural activity uses most of the land in the EU, Germany and *Nordrhein-Westfalen* in relative terms. It is worth remembering that the agricultural area used encompasses agriculture and livestock. The second largest area used is the forest area. Based on the data in Table 4, Graph 3 was also elaborated, which shows the percentage of use that each of the classifications occupies in Europe, Germany and *Nordrhein-Westfalen* in 2015.

Graph 3 | Percentage of land use according to European Union classification for the selected regions in 2015



Data source: Eurostat, 2019c.

Graph 3 shows that the largest percentage of land in the EU, Germany and *Nordrhein-Westfalen* is used for agriculture. Specifically, it is noted that the EU uses about 40% of the land for agricultural production. Germany and the state of *Nordrhein-Westfalen* have a higher land use, reaching 50% of the total. It should also be noted that forested areas are larger in the EU than in Germany. The *Nordrhein-Westfalen* region has 23% of the total forests.

The main differences between the EU, Germany and the state of *Nordrhein-Westfalen* lie in the fact that the latter two have an area in agricultural use, around 10%, larger than that used in the EU. In addition, it has a lower percentage of abandoned or unused land than the EU. Another difference lies in the higher residential urban use in Germany and *Nordrhein-Westfalen* than in the EU. In the case *of Nordrhein-Westfalen*, the figure is twice that of the EU, demonstrating a high supply of infrastructure and population density. This is related to the fact that the state of *Nordrhein-Westfalen* is the most populous in Germany, concentrating about 22% of the total population (Eurostat, 2020).

It should also be noted that, of the percentage used in agriculture in the three regions, most of it is destined to agricultural production. Of the total territory of the EU, approximately 25% is used for agriculture, while the other 15% belongs to livestock. For Germany and *Nordrhein-Westfalen*, the percentage is around 35% for agriculture and 15% for livestock (Eurostat, 2019a). This behavior is similar to that found for Paraná and the Western Mesoregion, both of which are specialized in the production of cereals.

Therefore, based on the analysis of data and environmental legislation, it can be inferred that the legal institutional arrangement established on the environmental issue in the EU and Germany was designed to encourage sustainable agriculture from an economic and environmental point of view. Such practices aim to improve the use of the soil and the maintenance of natural resources in order to allow their economic exploitation in a sustainable way.

On the other hand, Brazilian environmental legislation was drafted in a restrictive manner regarding the use of forest areas for economic exploitation. This is reflected in the restrictions on land use, in the various types of biomes, and in the fact that most of the Brazilian forest areas are made up of native areas. These restrictions are reinforced by the requirement for partial reforestation

of agricultural areas prescribed in the legislation. In this way, environmental legislation defines the priority of environmental preservation and biodiversity to the detriment of economic exploitation in these areas.

For Brazil, environmental legislation does not break with the contradiction between agricultural production and environmental preservation. Since there is the imposition of the adoption of environmental preservation measures through legislation to rural producers, which is not supported by a program of economic incentives to rural landowners to mitigate the economic impacts of the adoption of environmental measures proposed in the legislation. This fact will probably require spending on control and inspection by the State, due to the contradiction between the generation of income and the maintenance of the forest and biodiversity.

It is possible to say that the observed data reflect the measures directed by the legislation, both in the German and European regions as well as in the Brazilian ones. It was possible to verify a higher agricultural land use for regions of the EU and smaller areas in forest reserves, which can be exploited economically and, for the most part, are not areas of native vegetation.

Brazilian forest areas, unlike European ones, are constituted in such a way as to restrict their use in economic exploitation aiming at the maintenance of native forests and biodiversity in each biome. The data show that the forest areas in the Brazilian regions were higher than those found for the EU, Germany and *Nordrhein-Westfalen*. In addition, in the Brazilian regions, the percentages of existing forests exceed the percentages established by the legislation itself. This is a reflection of the greater restriction imposed by Brazilian legislation on forest areas.

It should also be noted that in the context of the regions studied, those specialized in cereal production, such as the Western Mesoregion and *Nordrhein-Westfalen*, had the highest percentages of land in agricultural use. The more specialized the region is in the production of cereals, the higher the percentage of the soil allocated to agricultural use. This fact reinforces the hypothesis of a trend of land concentration in areas specialized in the cultivation of cereals. Since the increase in the scale of production makes it possible to increase the profitability of producers without the immediate need for capital contribution, thus increasing the viability of the rural property.

CONCLUSIONS

With this research, it became clear that for Germany there is a rupture between the duality of agricultural production and environmental protection, which did not occur for Brazil. As a result of the analysis of the environmental legal apparatus, it was possible to verify a higher agricultural land use for regions of the EU, as well as smaller areas of forest reserves, mainly native. It can also be noted that the more specialized in the production of cereals, the higher the percentage of land use due to agriculture in the region.

It was also possible to perceive that environmental legislation directly influences the agricultural policy in force in Germany and indirectly in Brazil. For the farmer in Germany, environmental legislation has a positive influence on CAP subsidies and a reduced negative impact on land use, since the restrictions imposed by German legislation are limited compared to the Brazilian one.

Brazilian legislation, on the other hand, has a negative impact on the use of land for economic purposes for Brazilian and Paraná farmers and has a negative influence on agricultural income, without having direct compensation mechanisms. These results also make it clear that the restrictions imposed by Brazilian environmental legislation have resulted in larger areas of environmental conservation, including the preservation of native areas.

It should also be noted that this study does not exhaust the subject. There is a need for further studies to compare the environmental policies of other EU countries with those of Brazil, to compare and validate the data found on land use percentages, both for farming and for environmental reserves.

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REFERENCES

Brasil. (2012). Lei N° 12.651 de 25 de maio de 2012. Dispõe sobre a proteção da vegetação nativa. Diário Oficial da República Federativa do Brasil, Brasília. Web acess: http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm

Brasil. (1979). Lei N° 6.746 de 10 dezembro de 1979. Altera o disposto nos arts. 49 e 50 da Lei nº 4.504, de 30 de novembro de 1964 (Estatuto da Terra), e dá outras providências. Diário Oficial da República Federativa do Brasil, Brasília. Web Acess: http://www.planalto.gov.br/ccivil_03/LEIS/1970-1979/L6746.htm

Brasil. (1993). Lei N° 8.629 de 25 fevereiro de 1993. Dispõe sobre a regulamentação dos dispositivos constitucionais relativos à reforma agrária, previstos no Capítulo III, Título VII, da Constituição Federal. Diário Oficial da República Federativa do Brasil, Brasília. Web acess: http://www.planalto.gov.br/ccivil_03/leis/L8629.htm

Brandão, C. A. (2014). Teorias, estratégias e políticas regionais e urbanas recentes: anotações para uma agenda do desenvolvimento territorializado. Revista Paranaense de Desenvolvimento, Curitiba, 107, 55-74.

Bungenstab, D. J. (2012). Sistemas de integração lavoura-pecuária-floresta: a produção sustentável. Brasília, Embrapa, 239 pp.

BwaldG. (2020a) - DAS BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ. Gesetz über Naturschutz und Landschaftspflege (Bundesnaturschutzgesetz - BNatSchG). Web Acess: https://www.gesetze-im-internet.de/bnatschg_2009/BJNR254210009.html.

BwaldG. (2020b) - DAS BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ. Gesetz zur Erhaltung des Waldes und zur Förderung der Forstwirtschaft (Bundeswaldgesetz). Web acess: https://www.gesetze-im-internet.de/bwaldg/BJNR010370975.html#BJNR010370975BJNG000100319

BwaldG. (2020c) - DAS BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ. Gesetz zum Schutz vor schädlichen Bodenveränderungen und zur Sanierung von Altlasten (Bundes-Bodenschutzgesetz - BBodSchG). Web acess: https://www.gesetze-im-internet.de/bbodschg/BJNR050210998.html#BJNR050210998BJNG000200000

BwaldG. (2020d) - DAS BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ. Gesetz zur Ordnung des Wasserhaushalts (Wasserhaushaltsgesetz - WHG). Web acess: https://www.gesetze-im-internet.de/whg_2009/BJNR258510009.html#BJNR258510009BJNG000100000

Cavalieri, M. A. R. (2013). O surgimento do institucionalismo norte-americano de Thorstein Veblen: economia política, tempo e lugar. Economia e Sociedade, 47, 43-76.

Coase, R. H. (1993). The nature of the firm. In: WILLIAMSON, O.; WINTER, S. G. (Ed.). In the nature of the firm origins, evolution, and development. New York: Oxford University Press.

Comissão Europeia. (2000). Directiva 2000/60/CE do Parlamento Europeu e do Conselho de 23 de outubro de 2000, que estabelece um Quadro de Acção Comunitária no Domínio da Política da Água. Jornal Oficial das Comunidades Europeias, 1-72.

Comissão Europeia. (1992). Directiva 92/43/CEE do conselho europeu de 21 de maio de 1992 relativa à preservação dos habitats naturais e da fauna e da flora selvagens. Jornal Oficial das Comunidades Europeias, 1-66.

Conceição, O. A. C. (2007). Além da transação: uma comparação do pensamento dos institucionalistas com os evolucionários e pós-keynesianos. Revista Economia, Brasília, 7(3), 621–642.

EEA. (1995) - EUROPEAN ENVIRONMENT AGENCY. CORINE Land cover. Jan. 1995. Web acess: https://www.eea.europa.eu/publications/COR0-landcover/#additional-files

European Parliament. (2019). Fact Sheets on the European Union: The Common Agricultural Policy. Web acess: http://www.europarl.europa.eu/factsheets/pt/section/196/politica-agricola-comum-pac- Acess in: 20 nov. 2019.

EUROSTAT. (2019a). Crop production in EU standard humidity by NUTS 2 regions. Web acess: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apro_cpshr&lang=en Acess in: 10 nov. 2019a.

EUROSTAT. (2019b). Land cover and land use, landscape (LUCAS). Web acess: https://ec.europa.eu/eurostat/cache/metadata/en/lan_esms.htm Acess in: 02 dez. 2019c.

EUROSTAT. (2019c). Land use overview by NUTS 2 regions. Web access: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lan_use_ovw&lang=en Acess in: 02 nov. 2019c.

EUROSTAT. (2020). Population on 1 January by age, sex and NUTS 2 region. Web access: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_r_d2jan&lang=en Acess in: 17 apr. 2020.

Gass, S. L. B., Verdum, R., Corbonnois, J., & Laurent, F. (2016). Áreas de preservação permanente (APPs) no Brasil e na França: um comparativo. Confins. Revue franco-brésilienne de géographie/Revista franco-brasilera de geografia, 27. https://doi.org/10.4000/confins.10829

IAP. (2019). Módulos Fiscais dos Municípios do Estado do Paraná. Web Acess: http://www.iap.pr.gov.br/pagina-1328.html. Acess in: 01 nov. 2019.

IBGE. (2019a). Censo agropecuário – Tabela 503 - Área colhida de lavouras temporárias e permanentes por estado (No. Tabela 503). IBGE. Web acess: https://sidra.ibge.gov.br/Tabela/503 Acess in: 20 nov. 2019.

IBGE. (2019b). Indicadores do desenvolvimento sustentável – Tabela 896 - Desflorestamento bruto, anual e acumulado, na Amazônia Legal, em 01/08, e Taxa estimada, anual e acumulada, de desflorestamento bruto anual em relação à área total das Unidades da Federação que formam a Amazônia Legal, segundo as Unidades da Federação (No. Tabela 896). IBGE. Web acess: https://sidra.ibge.gov.br/tabela/896 Acess in: 27 ago. 2019.

IBGE. (2018). Monitoramento da cobertura e uso da terra do brasil 2014 – 2016. Rio de Janeiro, IBGE, 29 pp.

INCRA. (2018). Sistema Nacional de Cadastro Rural (SNCR). Web acess: http://www.incra.gov.br/tree/info/file/17092 Acess in: 15 ago. 2019

IPARDES. (2019). Produção agrícola por mesorregião do Paraná. Web acess: http://www.ipardes.gov.br/imp/index.php Acess in: 20 nov. 2019.

Lopes, H. C. (2015). O desenvolvimento econômico: uma proposta de abordagem teórica evolucionária e institucionalista. Estudo Econômico, 45(2), 377-400.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). Limites do crescimento: um relatório para o projeto do Clube de Roma sobre o dilema da humanidade. São Paulo: Perspectiva, 203 pp.

Mota, J. A., Gazoni, J. L., Reganha, J. M., Silveira, M. T. D., & Góes, G. S. (2008). Trajetória da governança ambiental. In: IPEA, Boletim regional e urbano n°1, 11-20.http://repositorio.ipea.gov.br/bitstream/11058/5523/1/BRU_n1_trajetoria.pdf

North, D. (1994). Custos de transação, instituições e desempenho econômico. Rio de Janeiro: Instituto Liberal.

Pintor, E. & Piacenti, C. A. (2021). Política agrícola no Brasil e na Alemanha: uma abordagem comparativa entre a Mesorregião Oeste do Paraná e estado de *Nordrhein-Westfalen*. Revista Campo-Território, 16(40 Abr.), 66–90. https://doi.org/10.14393/RCT164003

Rocha Jr. W. F. (2004). A nova economia institucional revisitada. Revista de Economia e Administração, 3(4), 301-319.
Santos, M. A. D., Ferreira Filho, J. B. D. S., Vieira Filho, J. E. R., & Ywata, A. X. D. C. (2017). Setor agropecuário brasileiro pós novo código florestal: uma simulação de impactos econômicos. Brasília, Ipea, 38 pp.

SILVEIRA, E. C. C. (2003). Metodologia Comparada: repensando sua relevância na construção da identidade latino-americana. *In:* Anais do Encontro Internacional da Sociedade Brasileira de Educação Comparada: construindo a identidade latino-americana. Porto Alegre: PUCRS.

Williamson, O. (1975). Markets and hierarchies in analysis and antitrust implication. London: Free Press, Macmillan Publishers.

Williamson, O. (1985). The economic institutions of capitalism: firms, markets, relational contracting. London: Free Press, Macmillan Publishers.