

Geopolitics and the territorialization of soybean production in the State of Paraná

A geopolítica e a territorialização da soja no Estado do Paraná

La geopolítica y la territorialización de la soja en el Estado de Paraná

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Abstract

This article aims to analyze how the expansion of soybean production in the state of Paraná, Brazil transcends local impacts, integrating into global dynamics. In Paraná, the production of commodities is strongly linked to the international market, being influenced by multinational corporations and trade agreements. Geopolitics reveals inequalities in territorial disputes, with large companies and agro-industrial cooperatives dominating vast areas, while small producers and traditional communities face difficulties in maintaining themselves. The study examines the production of commodities and the geopolitics of soybeans in the state, highlighting the role of territorialization, which involves the appropriation and reconfiguration of space by agribusiness stakeholders, driven by infrastructure aimed at exportation. Based on a literature review and data analysis obtained from IPARDES and IBGE, the results indicate that the expansion of soybeans reflects not only the search for new agricultural areas but also global pressures linked to the export of food and biofuels. The construction of roads and ports strengthens the concentration of power in the hands of large corporations, consolidating a “corporate space” that focuses on optimizing the flow of goods. Thus, soybeans in Paraná exemplify the interconnection between territory, territorialization, and geopolitics in the globalized agribusiness.

Keywords: Soybean. Territorialization. Geopolitics. Agribusiness. Paraná.

Resumo



O presente artigo tem como objetivo analisar como a expansão da soja no Estado do Paraná (Brasil) transcende impactos locais, integrando-se a dinâmicas globais. No Paraná, a produção de commodities está fortemente ligada ao mercado internacional, influenciada por corporações multinacionais e acordos comerciais. A geopolítica revela desigualdades na disputa territorial, com grandes empresas e cooperativas agroindustriais dominando vastas áreas, enquanto pequenos produtores e comunidades tradicionais enfrentam dificuldades para se manter. O estudo examina a produção de commodities e a geopolítica da soja no Estado, destacando o papel da territorialização, que envolve a apropriação e reconfiguração do espaço por atores do agronegócio, impulsionada por infraestrutura voltada à exportação. Com base em revisão bibliográfica e análise de dados obtidos através do Iparde e IBGE, os resultados indicam que o avanço da soja reflete não apenas a busca por novas áreas agrícolas, mas também pressões globais ligadas à exportação de alimentos e biocombustíveis. A construção de estradas e portos fortalece a concentração de poder nas mãos de grandes corporações, consolidando um “espaço corporativo” focado na otimização do fluxo de mercadorias. Assim, a soja no Paraná exemplifica a interconexão entre território, territorialização e geopolítica no agronegócio globalizado.

Palavras-chave: Soja. Territorialização. Geopolítica. Agronegócio. Paraná.

Resumen

El presente artículo tiene como objetivo analizar cómo la expansión de la soja en el estado de Paraná (Brasil) trasciende los impactos locales, integrándose en dinámicas globales. En Paraná, la producción de soja está estrechamente vinculada al mercado internacional, influenciada por multinacionales y acuerdos comerciales. La geopolítica revela desigualdades en la disputa territorial, con grandes empresas y cooperativas agroindustriales dominando vastas áreas, mientras que pequeños productores y comunidades tradicionales enfrentan dificultades para mantenerse. El estudio examina la producción de commodities y la geopolítica de la soja en el estado, destacando el papel de la territorialización, que implica la apropiación y reconfiguración del espacio por actores del agronegocio, impulsada por infraestructura orientada a la exportación. A partir de una revisión bibliográfica y el análisis de datos del IPARDES y el IBGE, los resultados muestran que la expansión de la soja no solo responde a la búsqueda de nuevas áreas agrícolas, sino también a presiones globales relacionadas con la exportación de alimentos y biocombustibles. La construcción de carreteras y puertos refuerza la concentración de poder en manos de grandes corporaciones, consolidando un “espacio corporativo” enfocado en la optimización del flujo de mercancías. Así, la soja en Paraná ejemplifica la interconexión entre territorio, territorialización y geopolítica en el agronegocio globalizado.

Palabras-clave: Soja. Territorialización. Geopolítica. Agronegocio. Paraná.

Introduction

The expansion of soybean cultivation in Brazil raises concerns that go beyond local environmental and social impacts, such as deforestation and soil degradation. With the planning of new infrastructure, this expansion may intensify, generating large-scale regional effects. These analyses, however, often ignore the global processes that drive this expansion. Soybean cultivation in the state of Paraná, located in the South region of

Brazil, is connected to the international market, where demand for agricultural commodities is influenced by decisions made by multinational corporations and trade agreements. Soybean production is part of a global network, and its growth must be understood within the economic and geopolitical dynamics that drive it (Dowbor, 2017).

Planted and introduced in Brazil in the late 1920s, soybean production began on a large scale between 1925 and 1935 (EMBRAPA, 2024). The first attempt at cultivation in the country occurred in 1927, when a small quantity of seeds were brought from the United States, although the Brazilian climate conditions were not favorable for its development (EMBRAPA, 2024).

It was only in the 1940s and 1950s that soybeans began to be cultivated on a larger scale, particularly in the South region of Brazil, more precisely in Paraná, Rio Grande do Sul, and Santa Catarina, which have a climate that is more favorable to the cultivation of this legume. The definitive boost to the growth of production occurred in the 1970s and 1980s, when the Brazilian government encouraged the expansion of soybeans to the Center-West Region, particularly the State of Mato Grosso (Fajardo, 2016).

This growth was driven by policies aimed at encouraging agricultural production, such as financing and research programs, including the work of the Brazilian Agricultural Research Company (*Empresa Brasileira de Pesquisa Agropecuária* – EMBRAPA), which developed soybean varieties that are adapted to Brazil's climate conditions. From the 1990s onwards, the country became one of the largest producers and exporters of soybeans in the world, a position it maintains to this day, with an emphasis on the export market to China (EMBRAPA, 2024).

Thus, as Paraná was part of the introduction of soybean growing in Brazil, the territorialization of soybeans in the state involves the appropriation and reconfiguration of the geographic space by agribusiness stakeholders, who use strategies to consolidate their control over the territory (Bulhões, 2007). This process is marked by the construction of infrastructures, such as roads, railways and ports, which facilitate the flow of production to the global market. Territorialization also manifests itself in the concentration of land in the hands of large corporations and agro-industrial cooperatives, which dominate vast areas, while small producers and traditional communities are marginalized or displaced (Elias, 2006). This phenomenon reflects a

logic of capital accumulation that prioritizes economic efficiency over social justice and environmental sustainability (Dowbor, 2017).

From a geopolitical standpoint, the expansion of soybean production in Paraná is part of a global context of competition for natural resources and markets (IPARDES, 2024). International demand for food and biofuels, particularly from countries in the European Union and China, puts pressure on Brazilian production, reinforcing the country's dependence on fluctuations in the global market. Additionally, multinational corporations are central to this process, influencing public policies and trade agreements that benefit their interests (Blum, 2015). The geopolitics of soybeans reveals an asymmetry of power, in which global stakeholders dominate the production chain, while the social and environmental impacts fall on local communities (Elias, 2002).

This dynamic is an expression of neoliberalism, which reorganizes geographic space to meet the demands of the global market (Santos, 1994). The integration of Paraná into international commodity circuits consolidates a "corporate space" aimed at optimizing the flow of goods and maximizing profits. Nevertheless, this integration also generates territorial conflicts, socioeconomic inequalities, and environmental challenges, which must be addressed through more inclusive and sustainable public policies (Nunes; Parré, 2013). Thus, the expansion of soybean production in Paraná exemplifies the complex interaction between territorialization, geopolitics, and globalization in the context of agribusiness.

Thus, the expansion of soybean production in Paraná is not limited to the search for new agricultural areas, but rather reflects, above all, global pressures for food and biofuels, policies to encourage exports, and the integration of the state into globalized value chains. The construction of new infrastructures, such as roads, railways, and port improvements, strengthens the concentration of power in the hands of large corporations, transforming the territory into a "corporate space" that connects cultivation areas to international markets. This process highlights the reconfiguration of geographic space in response to the demands of globalized agribusiness, consolidating a logic of production and circulation focused on maximizing profits and optimizing the flow of goods (Macedo; Júnior, 2019).

The purpose of this study is to analyze the production and geopolitics of soybeans in Paraná, highlighting the territorial dynamics and the stakeholders involved

in this process. The first part explores the contemporary meaning of geopolitics and territorialization in geography, relating these concepts to the soybean agricultural complex in the state and its insertion in globalized scales. Geopolitics, in this context, allows us to understand the asymmetries of power and inequalities that characterize the dispute over territories, while territorialization reveals the strategies of appropriation and reconfiguration of space by agribusiness agents. Grouped together in the first part, the methodology and the characterization of the study area are considered.

The second part of the study analyzes the spatial and temporal strategies of agro-industrial corporations, which act in a coordinated manner to expand their influence over the state of Paraná. The study examines the trends in the expansion of soybean production in the state, technology modernization, and public policies that favor the sector.

Finally, the third part of the study addresses the paths of soybean production and the fate of their production in the globalized world. The analysis highlights how soybeans from Paraná are incorporated into value chains that extend beyond national borders, meeting the demand for agricultural commodities in countries in Asia and the European Union. The study also discusses the socio-environmental impacts resulting from this expansion, such as land concentration, the displacement of traditional communities, and the degradation of local ecosystems. Simultaneously, the study reflects on the possibilities of a more inclusive and sustainable development model that balances economic interests with environmental preservation and social justice.

In order to ensure data consistency and quality, information collected from 1980 to 2024 from public and private institutions essential for the systematization of economic data for Paraná are incorporated in this study. Among these institutions, the following stand out: the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE), the Paraná Institute for Economic and Social Development (*Instituto Paranaense de Desenvolvimento Econômico e Social* – IPARDES), the Ministry of Agriculture, Livestock and Food Supply (*Ministério da Agricultura e Pecuária* – MAPA), the National Food Supply Company (*Companhia Nacional de Abastecimento* – CONAB), the National Institute for Colonization and Agrarian Reform (*Instituto Nacional de Colonização e Reforma Agrária* – INCRA), and the Brazilian Agricultural Research Corporation (*Empresa Brasileira de Pesquisa Agropecuária* – EMBRAPA).

Therefore, this study seeks to contribute to the understanding of the complex interactions between territory, geopolitics, and globalization in the context of soybean production in Paraná, highlighting the challenges and contradictions that are inherent in contemporary agribusiness.

Territorialization and geopolitics as guiding concepts

Geopolitics examines the ways in which power is exercised in the management of territories, extending beyond the military spheres of the State to encompass sectors such as planning, agriculture, development, and the environment (Karl, 2018; Giddens, 2009). It also involves the participation of stakeholders from civil society, universities, and research institutes, reflecting the complexity of the interactions between power and territory (Braudel, 1995).

Since ancient times, technological advances have been crucial to expanding territorial knowledge and defining strategic areas of power, with regions that are rich in resources often becoming centers of dispute (Braudel, 1995). Political geography, as a subfield, analyzes the evolution of States and territories, highlighting the interaction of multiple stakeholders. Thus, power over territory results from political, economic and social decisions, making geographic space an arena of constant disputes and negotiations (Agnew, 2012).

Friedrich Ratzel (1906) is widely acknowledged as the pioneer of political geography and geopolitics, establishing the foundations for the study of the relationship between space and power. His vision founded the discipline, which was soon expanded and reinterpreted by other theorists (Glacken, 2006).

According to Sorre (1984), Ratzel stated that the three domains (land, water, and air) would be the stage for the exercise of power in the territory, because:

In each of them, we can follow the progressive advance of men in the face of geographical obstacles, an advance conditioned by the adaptation of techniques, the specialization of machines and routes. The set of routes in the three domains, alongside the installations of their nodal points, forms the universal network of circulation. Knowledge will not be complete unless we associate the study of routes with the study of the exchanges of which they are an instrument. (Sorre, 1984, p. 95).

French geographer Camille Vallaux (1928) offers a relevant critique of Ratzel's work, expanding the geographer's analysis emphasizing the interdependence between territory and the formation of States. Vallaux (1928) describes logistics and circulation as central elements of reflection on geopolitics, since the analysis and intervention in contemporary territories permeate social relations and the various power arrangements present at different geographic scales. It manifests itself in an omnipresent manner, driven by the movements of people, goods, and information (Muehe, 2022).

In turn, Halford Mackinder's theory, proposed in 1905, highlights the strategic importance of the Eurasian region, referred to as the "Heartland" or "Heart of the World." Mackinder (1905) argued that any power that controlled the Heartland would have the power to dominate the world, as this vast region, strategically positioned and rich in natural resources, comprises the geopolitical center of connection between Europe, Asia, and the Middle East (Brzezinski, 1997).

In addition to the Heartland, Spykman (2020) introduced the concept of the Rimland, which refers to the areas surrounding the Heartland, such as the coastal regions of Europe, Asia, and the Middle East, which are equally important for the global balance of power (Spykman, 2020). Despite not being the strategic center of Eurasia, the Rimland plays a key role in influencing power dynamics due to its proximity to the Heartland and the importance of its control for external powers seeking to limit the power of those who control the Heartland (Agnew, 2003).

In the context of agribusiness, the Rimland theory is relevant as many of the large agribusiness cooperatives and corporations operate precisely in areas along the coasts and in strategic agricultural regions, which are often located in the Rimland, including China. Control over these regions occurs not only through production, but also through control of trade and distribution routes, which are crucial to global economies.

The relationship between the Rimland and agribusiness can be seen in the interactions between the countries that produce and consume these commodities. Control over these areas, both from a geopolitical and economic standpoint, allows major powers and corporations to influence global trade flows (Kaplan, 2009).

Thus, Thery and Neto (2023) emphasize that logistics, from a geopolitical perspective, integrates strategies of control and territorial integration, and are crucial to

consolidating the State in its territory. Initially linked to military intelligence, logistics evolved to encompass activities that are essential to national planning. Technologies such as steam navigation, railways, and aviation revolutionized geopolitics, making control of transport routes a central element of power.

In addition to the military field, logistics became an instrument of social control, particularly with the transition to the “governing State,” which, starting at the end of the 19th century, adopted interventionist and disciplinary practices (Brenner, 1994). According to Foucault (1979), this governmental power uses the organization and arrangement of space as means of domination and social control.

By applying this analysis to the State of Paraná, we can observe how state power reconfigures space through the creation of infrastructures, transportation, and communication networks, which not only connect strategic areas, but also control resource flows and stocks (Blum, 2015). This is in line with what Lefebvre’s (1978) observations, in which the State produces its own space, implementing a network of technical and political control, which serves both national strategic interests and local private interests.

In the case of Paraná, the development of infrastructure, such as the construction of highways and railway integration projects, reflects this dynamic of spatial control. For example, the highway axis that connects the port of Paranaguá to the interior of the State not only facilitated the flow of agricultural and industrial products, but also reinforced the integration of the state into the national and international economy (Souza; Nascimento, 2007). Furthermore, the expansion of agricultural frontiers in western Paraná during the 1960s and 1970s exemplifies the imposition of this control network, in which large colonization and agricultural modernization projects were promoted by the State, often to the detriment of local and indigenous populations (Oliveira; Iglesias, 2002).

The construction project of Nova Ferroeste, connecting the states of Mato Grosso do Sul, Paraná, and Santa Catarina by means of railways, also demonstrates how strategies are configured in Brazilian territory (Ferroeste, 2024). In these project initiatives, both state power and national and international private power are counted on to get the project off the ground. In this case, we can clearly see how global issues affect regional issues within a country, as these influences are managed with the partisan

interests of the stakeholders involved, in addition, of course, to the interests and diplomatic relations (Becker, 2005).

In this way, the logistics and spatial strategy of the State in Paraná are articulated in a network of control, connections, and circuits, which reinforce the spatial order linked to subjective interests, often in opposition to general interests. This process reveals the contradictions between the state logistics space, focusing on control and efficiency, and the lived space, where daily practices and local interests manifest themselves in divergent ways. Becker (2005, p. 286) describes that logistics “[...] carries out true territorial ordering in a dense branching network, involving numerous locations in areas, at points, as well as varied and multidirectional flows, which articulate its activities and those of other groups”. The technological revolution, driven by advances in microelectronics and communication, have transformed geopolitical and logistic concepts, reorganizing the economy, society, and politics around information and knowledge. According to Manuel Castells (2002), this new organization is based on the control of technical networks and flows, while Paul Virilio (1984) highlights that logistics began to focus on the management of time and the flow of information and goods, in addition to physical movement.

According to Moñivas Lazáro (1994), however, the territory presents a polysemic complexity that is being addressed here, reflected in its use in different areas of the social and human sciences. Its interpretation varies according to the theoretical traditions, schools of thought, and paradigms in which it is used. This diversity also extends to derived or related terms, such as territoriality, multi-territoriality, territorialization, and deterritorialization, which carry different meanings depending on the context in which they are applied (Bilbao, 2024).

Thus, when discussing the concept of territorialization in the context of the soybean complex in Paraná, it is necessary to understand it as a dynamic and multidimensional process, which involves the appropriation, organization, and reconfiguration of geographic space by agribusiness stakeholders. The territorialization of soybean production is not limited to the simple physical occupation of the territory; rather, it encompasses control and management strategies that aim to optimize the production, flow, and trade of this commodity on a global scale (Borges; Calaça, 2007). This process is driven by investments in logistics infrastructure, such as roads, railways,

and ports, which connect the producing areas to international markets, consolidating a “corporate space” that focuses on economic efficiency (Dowbor, 2017).

According to Haesbaert (2004), a territory is defined by social, economic, political, and environmental relations, considering the historical context. It must be understood in a multidimensional way, encompassing different dimensions (productive, economic, political, social, environmental, cultural, educational, material, and immaterial), which interact and contribute to its construction. Fernandes (2014) warns that analyzing these dimensions in an isolated context creates artificial dichotomies and hinders the understanding of multi-scalarity, i.e., territorial connections from the local to the international level. In this context, territories are spaces where social subjects carry out their life projects, organizing them according to their priorities and political decisions.

An example of this is agribusiness, which structures the territory while prioritizing the production and marketing of goods. Fernandes (2009) observes that, even when a territorial agent focuses its actions on a specific dimension, the others end up being impacted. This occurs because the territory, by its very nature, is simultaneously multi-scalar and multidimensional.

Understanding the territory in its entirety requires a dialectical reading that considers the pairs that generate contradiction, solidarity, and conflict. These relationships are intrinsic to social dynamics, as the territory is deeply linked to the identity of the individuals and groups that occupy and appropriate it (Santos, 1994). It is under the influence of subjects or groups that hold the power to transform it, making it susceptible to constant change. Thus, the ability to construct and assign meanings to the territory is manifested through intentional cognitive and practical actions, which produce both material and immaterial territories (Santos, 2002).

The connection between power and territoriality arises precisely from the theoretical and practical plans of territorial control, which are determined by a set of economic, cultural, political and social variables (Agnew, 2005; Allen, 2003). At each historical moment, these variables assume a specific essence, giving the territory a particular configuration and meaning. As Santos (2002, p. 120) states, territorialization is directly related to the power relations that act on a referential substrate, spatially delimiting these interactions. In this sense, territoriality refers to that which transforms

any space into a territory, i.e., the power relations that define and organize it (Souza, 2000, p. 99).

In this way, the territory is not only a physical space, but also a social and political construct, shaped by the power relations and practices of the stakeholders who occupy it (Santos, 2006). This perspective allows us to understand how the territory is constantly reconfigured, reflecting the dynamics of control, dispute and significance that characterize each historical and social context (Harvey, 2001).

A comprehensive understanding of the territory requires a dialectical approach, which acknowledges the contradictions, solidarities, and conflicts that are inherent in social relations. The territory is not a mere physical space, but rather an essential element in the construction of the identity of the individuals and groups that appropriate it. Being dynamic and susceptible to transformations, it is always subject to actions and disputes over power (Lefebvre, 1978).

The ability to construct and assign meanings to the territory is linked to the knowledge and intentional practices of social agents, resulting in territories that combine material and immaterial dimensions, configuring territorialization. The link between power and territory is manifested in the mechanisms of spatial control, shaped by economic, political and cultural variables throughout history, with new meanings and configurations in each period (Santos, 2002). In this context, territorialization reflects how power relations are structured spatially, influencing the organization and use of the territory, with the delimitation of power relations over a specific substrate (Souza, 2000).

From a geographical standpoint, Haesbaert (2004) and Pecqueur (2006) approach territorialization by considering the multiplicity of powers exercised by the different agents involved in the economic and political processes that shape a territory. Territorial strategies and institutional and productive arrangements contribute to directing the functionality of a given portion of space, according to the interests of these agents (Sassen, 2006).

According to Antonsich (2011), broadly speaking, territorialization configures a model of social and economic development that is able to boost both the production and trade of certain products and the dynamization of service chains. This process can directly influence the growth of cities, regions, and territories where such dynamics are

established. In the context of rural social movements, territorialization occurs through the collective action of these groups, challenging the view that only large enterprises and conglomerates would be responsible for territorial transformations (Antonsich, 2011).

Territorialization refers to the process of formation and structuring of territories, involving human settlement and technical control over the land, being linked to the way in which social groups organize and reorganize space, influencing its development (Paasi, 2003). Centralized agrarian policies can reinforce the actions of large corporations, structuring territories according to the logic of global capital and limiting the participation of social groups that have been historically linked to the land. Thus, territorialization can be both an instrument of inclusion and resistance and a mechanism that reinforces inequalities and exclusion.

Territorialization involves different forms of social organization, varied perceptions of the territory and strategies to organize it, reflecting power relations and economic and political interests, in addition to the cultural and environmental specificities of each location (Brenner, 1999). This process, from a social, spatial, and economic standpoint, results from the application of techniques and strategies that consolidate specific economic niches in territorial planning, aiming to boost economic activities and dynamize local and regional markets (Brenner, 1999; Allen, 2003).

In the case of Paraná, the territorialization of agribusiness reflects this dynamic, as soybean production has become one of the main economic vectors of the state. The expansion of this sector is directly linked to institutional and legal policies that have favored agricultural modernization, logistics infrastructure, and access to international markets. This territorial configuration not only strengthens the model of large properties focusing on exports, but also influences local production chains and the organization of geographic space, establishing an interconnected network of production, transportation, and marketing.

The territorialization of agribusiness in Paraná, thus, exemplifies how political and economic processes shape territories, reinforcing the role of the state as one of the main exporters of agricultural commodities. Simultaneously, this dynamic generates challenges related to the concentration of land ownership, environmental impacts, and

the exclusion of small producers, demonstrating that territorialization can take different forms and consequences, depending on the agents involved and the policies adopted.

Methodological procedures

This section aims to specify and characterize the study area, in addition to describing in detail the methods and methodologies used to obtain the results of this research. The choice of methodological approaches is crucial to guaranteeing the accuracy and credibility of the analysis, making it essential to explain the procedures adopted throughout the study.

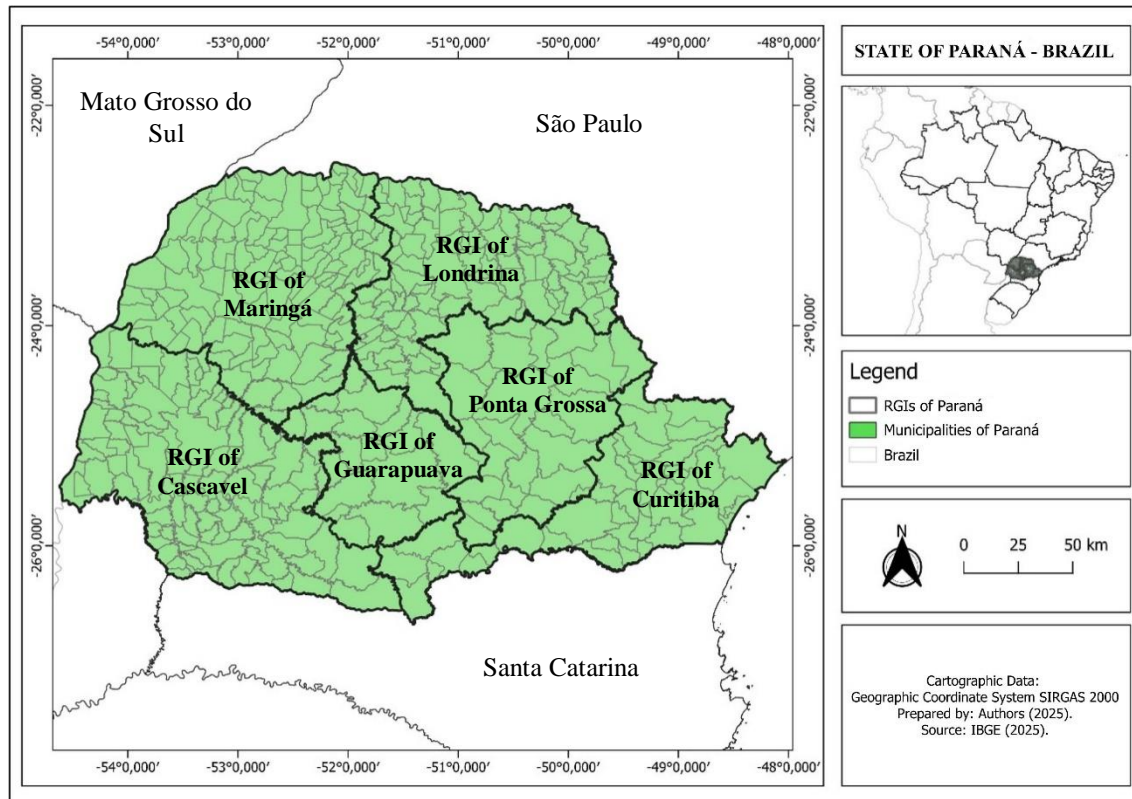
Therefore, Paraná, located in the South Region of Brazil, is composed of 399 municipalities distributed over an area of 199,880 square kilometers. The territorial division was reformulated by the Brazilian Institute of Geography and Statistics (IBGE) with the introduction of the Intermediate Geographic Regions (*Regiões Demográficas Intermediárias* – RGIs), which replaced the old mesoregions. Thus, the Intermediate Geographic Regions of Paraná consist of: the Intermediate Geographic Region of Curitiba, the Intermediate Geographic Region of Ponta Grossa, the Intermediate Geographic Region of Londrina, the Intermediate Geographic Region of Maringá, and the Intermediate Geographic Region of Cascavel.

According to estimates by the IBGE in 2024, the population of Paraná reached the milestone of 11.8 million inhabitants, accounting for 5.5% of the country's population. Figure 1 below shows the location of the State of Paraná as well as the Intermediate Geographic Regions (RGIs) of the State.

The research was developed based on a bibliographic, exploratory and descriptive methodological approach. The choice of these approaches aimed at an in-depth analysis of the regional and global dynamics of the soybean complex, based on the collection and analysis of secondary data. The bibliographic research allows the necessary theoretical construction, based on authors who discuss quantitative and qualitative methodologies, such as Godoy (1995) and Johnson and Wichern (1988), among others. These authors provide a robust theoretical basis for the analysis of quantitative and qualitative data, which is essential for the development of the study. Furthermore, the research used as sources books and scientific articles collected on

research platforms such as Elsevier, Taylor & Francis, SciELO, Springer, CAPES, CLASE, Google Scholar, and relevant Brazilian journals, such as the Cerrados journal.

Figure 1 – Location map of the Intermediate Geographic Regions (RGI) of the State of Paraná



Source: IBGE (2025). Prepared by the authors.

To ensure data consistency and quality, data from public and private institutions that are important for the systematization of economic data for Paraná were also used, such as the Brazilian Institute of Geography and Statistics (IBGE), the Paraná Institute for Economic and Social Development (IPARDES), the Ministry of Agriculture, Livestock and Food Supply (MAPA), the National Food Supply Company (CONAB), the National Institute for Colonization and Agrarian Reform (INCRA), and the Brazilian Agricultural Research Corporation (EMBRAPA). The information from these institutions provided an empirical basis for understanding the dynamics of the agricultural sector and the soybean complex, complementing the theoretical analysis and enabling an in-depth description of the characteristics of the sector and its insertion in global dynamics.

The territorialization of the soybean complex in the State of Paraná

Soybean production has consolidated itself as one of the main global commodities, and is important both in the human food industry and in the production of animal feed. In the period 1980-2005, global demand for soybeans grew at an average annual rate of 5.5%, resulting in an increase of 174.3 million metric tons in global consumption. In this context, South America emerged as a key region in soybean production, increasing its share from 30% to 47.8% of global production by 2006. In the same year, Brazil and Argentina accounted for 91.8% of the increase in global soybean supply, consolidating their position as leaders in the supply of this commodity (Pinazza, 2007).

In Brazil, the expansion of soybean production gained significant momentum from the 1970s onwards. The area dedicated to soybean cultivation jumped from 6.949 million hectares to 23.467 million hectares by 2010, making it the fastest growing agricultural crop in the country, representing 49% of the total area allocated to grain planting (EMBRAPA, 2011).

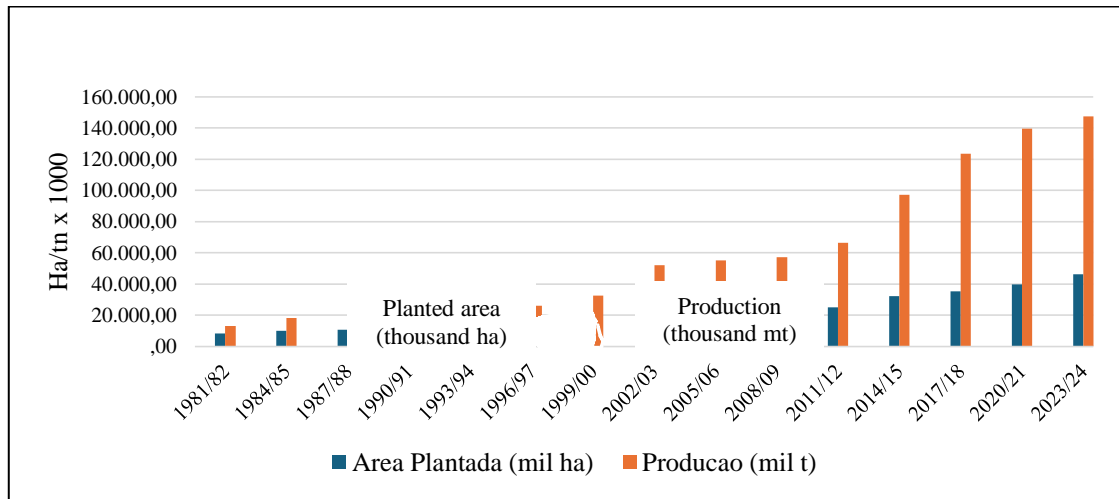
Consequently, Brazil has established itself as the world's second largest soybean producer, behind only the United States. This growth was driven by a combination of stakeholders, including technological advances, improvements in crop management, and increased producer efficiency. Nevertheless, the main factor was the expansion of the agricultural frontier, particularly in Brazil's Center-West region, in areas of the Cerrado biome.

The increase in soybean production in Brazil is related to the consolidation agribusiness and its insertion in the international commodities market, as highlighted by Delgado (2001). The strengthening of Brazilian agribusiness is due to the growing global demand, especially for soybeans, and the integration of production chains with efficient logistics. Nevertheless, large global corporations face pressure to ensure that their products are not linked to illegal deforestation, which could affect Brazil's competitiveness in the global market – a persistent challenge as of 2024.

Graph 1 shows the evolution of soybean production and harvested area in Brazil since 1980, evidencing accelerated growth from 1991 onwards, with production multiplying tenfold in the last 31 years, reflecting technological advances and the expansion of cultivated area. The harvested area of soybeans in Brazil jumped from 10

million hectares in 1981, for example, to 46 million hectares in 2024. Soybean production followed this leap, as in 1981 soybean production in Brazil was approximately 11 million metric tons and in 2024 production broke a record, obtaining approximately 150 million tons of the aforementioned grain.

Graph 1 – Production (thousand metric tons) and harvested area (thousand hectares) of soybeans in Brazil in the period 1981-2023



Source: CONAB (2024). Prepared by the authors.

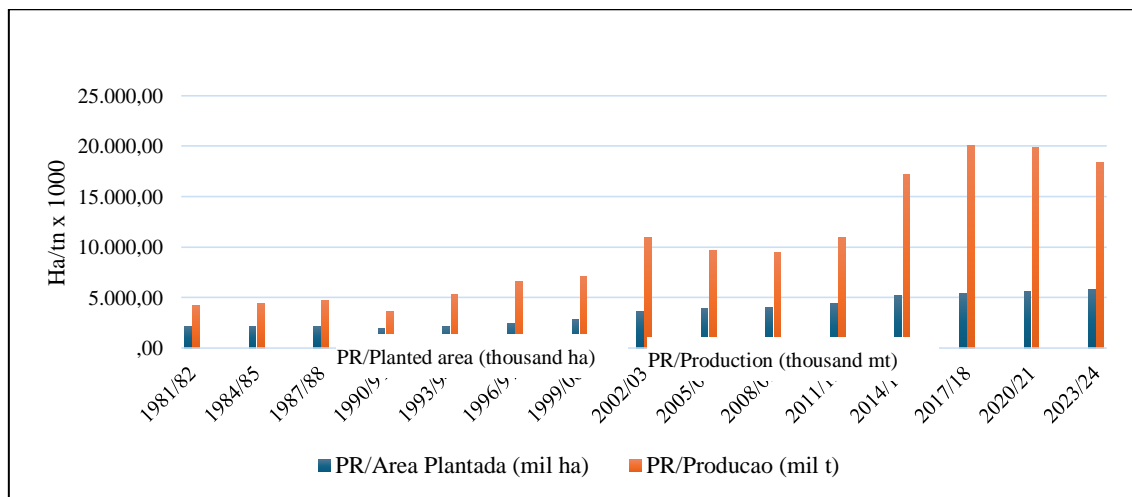
The modernization of Brazilian agriculture was mainly expressed in the cultivation of soybeans, which became one of the pillars of the country's agricultural production and land use, being carried out initially in the South and Southeast, and later in the Center-West. This process transformed Brazil into one of the world's largest soybean producers, consolidating it as a key player in the global agricultural commodities market (EMBRAPA, 2011).

The expansion of soybean production in Brazil reflects changes in global rural development, from modernization in the 1960s to market liberalization and rural empowerment (Ellis; Biggs, 2005). In 2023, the country reached a record of 150 million metric tons on 47 million hectares (EMBRAPA, 2023). In Paraná, production grew from 3.5 million metric tons in 1970 to 11 million in 2000, becoming the country's second largest producer, behind Mato Grosso (IPARDES, 2023). This growth was driven by global demand, state investment in infrastructure, and innovation by EMBRAPA, which developed adapted varieties and management techniques. Improved

logistics with highways, ports, and warehouses reduced costs, consolidating soybeans as the basis of Paraná's agribusiness.

The modernization of agricultural practices and the mechanization of crops in Paraná contributed to the professionalization of the sector and increased production efficiency. The use of advanced technology in machinery and the training of producers increased productivity per hectare, placing the state among the most productive in the country. Graph 2 shows the evolution of soybean production in Paraná in the period 1980-2024, highlighting its continuous growth and the important role of soybeans in the state's economy. It can be seen that in 1981 the harvested area of soybeans was around 3 million hectares in Paraná, while in 2024, the harvested area increased to approximately 5.2 million hectares. Soybean production has followed this increase, as in 1981, soybean production was around 4 million metric tons, while in 2024, production reached the milestone of 18 million metric tons.

Graph 2 – Soybean production (thousand metric tons) and harvested area (thousand hectares) in Paraná in the period 1981-2023



Source: CONAB (2024). Authors' own work.

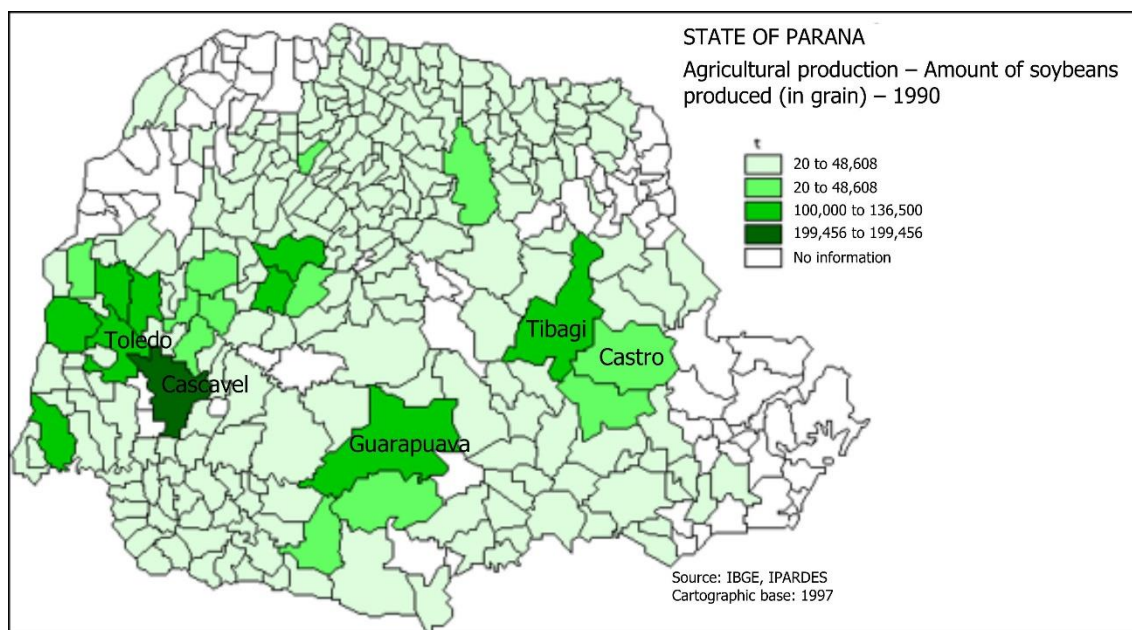
Soybean production in Paraná has grown significantly since 2011, rising from 14.2 million tons in 2012/2013 to an estimated 18.23 million in 2023/2024 (CONAB, 2024). This increase reflects both the expansion of the planted area and technological advances in cultivation and management. Nevertheless, the expansion of soybeans has brought challenges, such as the replacement of pastures and other crops, impacting biodiversity and putting pressure on natural resources. The intensive use of pesticides

and fertilizers has generated environmental concerns, while the concentration of land in large properties has aggravated land conflicts and the expulsion of small producers, accentuating social inequalities in the field.

Figure 2 shows the map that illustrates the distribution of soybean production in the municipalities of Paraná in 1990. In 1990, there was a significant expansion of the areas cultivated with soybeans in Paraná, advancing to the Center-South and Southwest of the state. Municipalities such as Pato Branco and Guarapuava emerged as production hubs, evidencing the expansion of the agricultural frontier and the adoption of modern cultivation techniques.

The redistribution of production in 1990 reflects the increased demand for the commodity, technological advances, and public policies to encourage agriculture, which consolidated soybeans as one of the main pillars of the economy of Paraná.

Figure 2 – Spatial distribution of soybean production in the municipalities of Paraná in 1990



Source: IPARDES (2024).

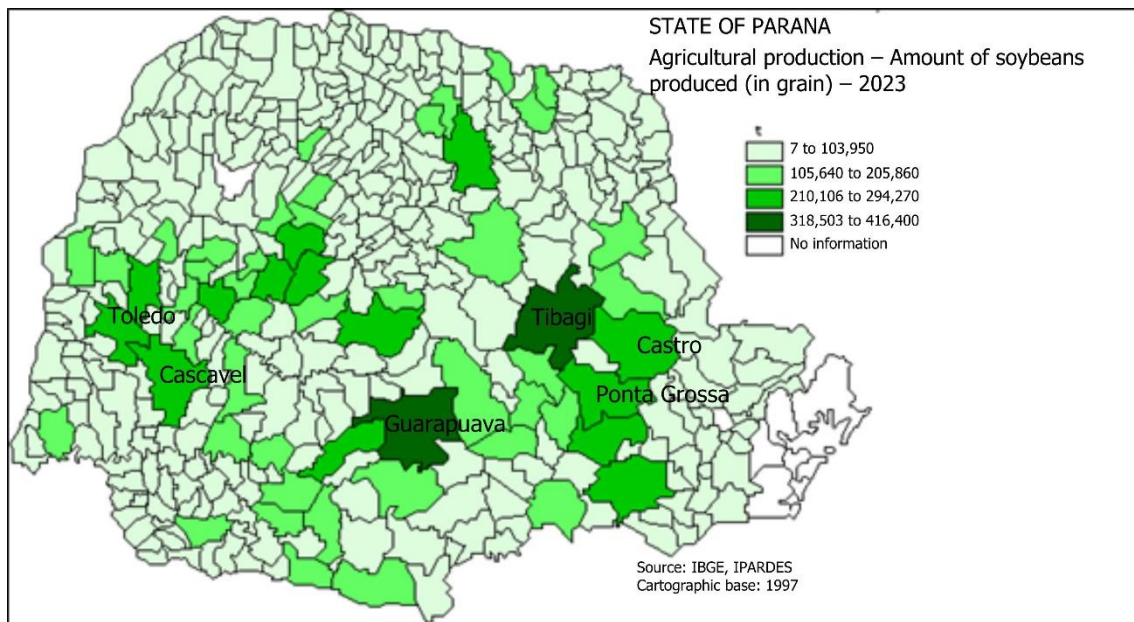
Throughout the first decade In the 21st century, Paraná consolidated itself as one of the largest soybean producers in Brazil, with emphasis on the RGIs of Cascavel, Guarapuava, and Ponta Grossa. Municipalities such as Toledo, Cascavel, Tibagi, and Guarapuava led the state's production, reflecting the strategic nature of the crop for the

state's agricultural economy. In 2023, Paraná reaffirmed its position as one of the country's largest producers, with a planted area of 5.7 million hectares and an estimated production of 18.5 million metric tons, according to data from the Rural Economy Department of Paraná (DERAL) and CONAB (2024).

In addition to the traditional production hubs, municipalities such as Guarapuava and Ponta Grossa have emerged as major production centers, particularly in the center-south region. The expansion of soybean production was driven by favorable climate, soil, and infrastructure conditions, which consolidated the position of the RGIs as leaders in agricultural production.

Figure 3 shows the spatial distribution of municipalities with the highest soybean production rates in Paraná throughout the second decade of the 21st century, with an emphasis on the year 2023. In that year, the municipalities of Tibagi, Toledo, Cascavel, and Guarapuava consolidated their positions as major soybean producers in Paraná, with a special emphasis on Tibagi, which leads in the state, and on Guarapuava and its neighboring municipalities, which have been growing significantly in soybean production.

Figure 3 – Spatial distribution of soybean production in Paraná municipalities in 2023



Source: IPARDES (2024).

In 2023, Tibagi was the largest soybean producer in Paraná, with 416,400 metric tons and 97,500 hectares planted. Toledo and Cascavel, both traditional soybean producers, also maintained significant production, with Toledo reaching 230,584 metric tons and Cascavel around 294,270 metric tons. Guarapuava, in turn, recorded significant growth, with a production of 318,504 metric tons in 2023, consolidating itself as a new agricultural hub in the center-south region of the state. Since 2018, soybean production in Guarapuava has remained above 280 thousand metric tons. The only region in Paraná that does not currently grow soybeans is the coastal region.

According to Fajardo (2016), until the 1990s, Paraná's agrarian model was strongly based on cooperatives, with rural producers joining together to process and sell their products on a collective basis. Nevertheless, from the 1990s onwards, agricultural cooperatives underwent a process of modernization, adopting business strategies to compete in a globalized market. This movement prioritized large producers and changed the profile of cooperative members, in addition to transforming the identity of cooperatives, many of which incorporated the term "agro-industrial" into their names.

Delgado (1985) describes this transformation as the emergence of the "multi-cooperative," an entity diversified in sectors and spaces, while Müller (1989) addresses the "techno-economic modernization," marked by agricultural industrialization and the intensive use of technology. These changes not only modernized agricultural practices, but also transformed social and political relations in the countryside. The so-called "Modern Agrarian Standard" integrated agriculture and industry, creating interdependent production chains and strengthening agribusiness.

In Paraná, cooperatives such as Agrária, Coamo, Copacol, and Frísia stand out at the national and international level for their economic impact and ability to adapt to the global market. These organizations united small and medium-sized producers, promoting economies of scale, access to advanced technologies and innovation. Consequently, they consolidated themselves as pillars of Paraná's agribusiness, contributing to regional development and job creation.

Coamo, headquartered in Campo Mourão, is an emblematic example of this evolution. Recognized as a leader in the agricultural sector, it ranks 7th in per capita revenue, with a wide diversification of activities. Other cooperatives, such as C. Vale and Cooperativa Lar, also illustrate the competitiveness of the Paraná model, ranking

41st and 199th in global revenue, respectively. These cooperatives operate not only in the production of grains and meats, but also in exports, consolidating the state's agribusiness on an international scale (WCM, 2023).

The leading role of Paraná cooperatives is evidenced by the global ranking of per capita revenue, in which 11 of them are among the largest in the world, according to the World Cooperative Monitor (2023). In addition to C. Vale and Cooperativa Lar, Cocamar (73rd), Copacol (83rd), Agrária (108th), Integrada (114th), Castrolanda (115th), Frimesa (119th), Frísia (139th), and Coopavel (147th) stand out. This performance reflects not only their production capacity, but also the efficiency in management and the economic return generated for their members. The presence of these cooperatives on the global stage demonstrates their high level of organization and their ability to adapt to the demands of an increasingly complex and competitive market.

The relationship between the State and cooperatives in Paraná, marked by incentives such as technical support and easy credit, strengthened cooperativism as a driver of regional development, particularly in agribusiness (Fajardo, 2016). Favorable legislation, including tax exemptions and advantageous financing, were essential to modernizing and increasing the competitiveness of the sector (Loureiro, 1981).

Main destinations for Paraná soybeans

Based on the geopolitical strategy of Ratzel (1906) on the position and situation of places and Camille Vallaux (1928) on territorial location, Paraná occupies a central position in Brazil, connecting different states and bordering São Paulo, the country's main economic center. In addition to being a route for Argentine and Paraguayan tourists, its highways are essential for transporting supplies, including grains from Paraguay to the Port of Paranaguá (IPARDES, 2024). The strategic location of the state, combined with its transportation systems – railways, highways, and ports – facilitates the movement of goods and makes Paraná an essential logistics hub for the flow of soybeans, consolidating its importance in international trade (IPARDES, 2024).

As for the destination of this production, in 2023, soybeans consolidated themselves as the main product of Paraná's exports, representing 23.5% of the total amount sold abroad. Paraná exported goods to 215 different destinations, with China standing out as the largest buyer. The volume of exports to the Asian country almost

doubled when compared to 2022, jumping from \$3.6 billion to approximately \$7.1 billion. This represents growth and demonstrates the intentions of trade relations between Paraná and China (IPARDES, 2024).

In 2022, Paraná played a key role in Brazilian exports, reaching a total volume of \$16.76 billion, with a strong predominance of agribusiness. The soybean complex remained the main highlight, accounting for 34.59% of total exports, highlighting its importance in the state economy (DERAL, 2022).

China has consolidated itself as the largest consumer market for Paraná soybeans, importing approximately 4.09 million metric tons, which resulted in roughly \$2.47 billion in revenue. This significant demand is related to the Asian country's need to supply its animal feed industry and vegetable oil production (IPARDES, 2024).

The Netherlands ranked second among the main destinations for Paraná soybeans, acquiring 658,000 metric tons, equivalent to \$346.8 million. The European presence in this sector is justified by the use of oilseeds in both animal feed and the production of biofuels (IPARDES, 2024).

South Korea was the third largest importer, with a volume of 549,000 metric tons and \$299.7 million in revenue. South Korea's demand is linked to the agricultural sector, which depends on soybeans as a raw material for animal feed and processed food products.

These figures demonstrate the relevance of Paraná in the global soybean market, reinforcing its position as one of the main Brazilian exporters and highlighting its strong integration into international production chains.

Logistics, from the standpoint of strategic points, territorial control and production flow, is crucial to the management of space. Jin and Li (2007) define it as a multifunctional structure that integrates transportation, trade, industry, and distribution, ensuring efficient services and boosting economic growth. To optimize this process, it is essential to plan transportation management, minimizing bottlenecks and reducing costs on a national and international scale.

In human geography, logistics is analyzed as a factor that influences the circulation of capital and reorganizes geographic space, impacting land use (Silveira, 2011). Although its influence is more evident in the capitalist system, its territorial transformations occur in different economic models. Thus, in addition to enabling

transportation and storage, logistics becomes an essential strategic element for economic competitiveness on multiple scales (Silveira, 2011).

Logistics on an international scale enables global interconnection, influencing industrial location, trade patterns, and regional development through ports, airports, and transportation networks. In Paraná, the consolidation of circulation routes is linked to the expansion of pioneering fronts and soybean production, connecting to the agricultural regions of northern Argentina and Paraguay (Thery; Neto, 2023). This strategic position reinforces its role as an economic link between Brazil and neighboring countries.

One relevant example comprises the ports of the Northern Arc, which offer an efficient alternative for the flow of soybeans, reducing congestion and bringing production closer to the Asian market. Nevertheless, the expansion of this crop raises environmental concerns, mainly due to the risk of deforestation in tropical forest areas, highlighting the need to preserve natural ecosystems (Silva, Souza; Oliveira, 2024).

Circulation, as a geopolitical element, is crucial in the configuration of contemporary territories, influencing social relations and power arrangements at different scales, driven by the flow of people, goods, and information, as noted by Camille Vallaux (1928).

In addition to its structuring role, it is necessary to consider Gottmann's (1952) vision, which highlighted the existence of spaces of resistance where flows encounter political, cultural, economic, or social barriers. These spaces arise from distinct cultural identities, conflicting interests, or territorial control policies that limit mobility.

Furthermore, the impacts of circulation on the territory are not ephemeral, leaving deep marks that can last for decades. Logistics infrastructures, land use patterns, and economic dynamics shaped by circulation flows often reconfigure landscapes and power relations, consolidating new territorialities and redefining geographic and political boundaries.

Final remarks

The expansion of soybean production in Paraná illustrates the complex interaction between territory, geopolitics, and globalization, highlighting the challenges

and contradictions that are inherent in contemporary agribusiness. The State plays a central role in this process, acting not only as one of the largest producers and exporters of soybeans in Brazil, but also as a strategic territory for the operations of large global corporations and agro-industrial cooperatives. By reconfiguring the geographic space through investments in infrastructure and technologies, these stakeholders consolidate a “corporate space” that focuses on optimizing the flow of goods and maximizing profits, to the detriment of local interests and environmental sustainability.

The theory of soybean territorialization helps to understand how the territory of Paraná was appropriated and transformed by agribusiness agents, driven by global pressures and demands from the international market. The construction of highways, ports, and warehouses, coupled with the modernization of farming techniques, has enabled Paraná to become part of global commodity chains. This territorialization, however, has also reinforced the concentration of power in the hands of large transnational corporations and cooperatives, which dominate vast areas and control the most profitable stages of the production chain, marginalizing small producers and traditional communities.

From the standpoint of the geopolitics of capital, Paraná has become a strategic territory for the accumulation of wealth on a global scale. Large corporations, often headquartered in developed countries, exert significant influence over public policies and territorial dynamics, redefining geographic space to suit their needs. This process, however, generates socio-spatial tensions, such as the expulsion of local communities, environmental degradation, and the reduction of productive diversity, with traditional crops being replaced by monocultures geared aimed at exports.

In this context, the role of the State of Paraná is ambiguous. On the one hand, it promotes development policies and infrastructure investments that boost soybean production and exports, consolidating the state as a global player in the commodities market. On the other hand, the relaxation of environmental controls and the prioritization of corporate interests to the detriment of more inclusive social and environmental policies have exacerbated issues such as territorial inequality and the unsustainability of the agricultural model.

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