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AGRARIAN REFORM IN PONTAL DO PARANAPANEMA – SÃO PAULO: AN ANALYSIS FROM THE PERSPECTIVE OF LANDFORM APPROPRIATION

Reforma Agrária no Pontal do Paranapanema – São Paulo: uma análise a partir da apropriação do relevo

Reforma Agraria en Pontal do Paranapanema – São Paulo: un análisis a partir de la apropiación del relieve

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ABSTRACT

The Pontal do Paranapanema, a region located in the far west of São Paulo state, has a complex history marked by land disputes and intense environmental transformation. Since the late 19th century, land conflicts and the expansion of the agricultural frontier have shaped the local landscape. The suppression of native vegetation for activities like sugarcane monoculture and extensive livestock farming has exacerbated problems such as soil erosion. Concurrently, in the late 20th century, the territorial organization was reconfigured through the creation of several rural settlements. However, studies show how the distribution of land is based, among other factors, on its environmental characteristics, especially its susceptibility to erosive processes. This paper seeks to analyze the spatial distribution pattern of land in the Pontal do Paranapanema across different land tenure categories, emphasizing its qualitative nature, based on the concept of Environmental Fragility (Ross, 1994). Based on studies on Environmental Fragility and land structure, this work presents a reflection on the environmental characteristics of the territories designated for agrarian reform policies in the Pontal do Paranapanema, demonstrating that the appropriation of the relief constitutes a relevant element in the history of territorial disputes in the region.

Keywords: Environmental Fragility; Agrarian Reform; Appropriation of the Relief; Pontal do Paranapanema.

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RESUMO

O Pontal do Paranapanema, região localizada no extremo oeste paulista, possui uma complexa história marcada por conflitos fundiários e intensa transformação ambiental. Desde o final do século XIX, disputas por terras e a expansão da fronteira agrícola têm moldado a paisagem local. A supressão da vegetação nativa, em prol de atividades como a monocultura da cana-de-açúcar e a pecuária extensiva, agravou problemas como a erosão dos solos. Paralelamente, no final do século XX o ordenamento territorial foi reconfigurado a partir da criação de vários assentamentos rurais. Entretanto, estudos mostram como a distribuição das terras estão embasadas, dentre outros fatores, em suas características ambientais, especialmente na susceptibilidade a processos erosivos. Este trabalho busca analisar o padrão de distribuição espacial das terras do Pontal do Paranapanema em diferentes categorias fundiárias, enfatizando seu caráter qualitativo, baseando-se no conceito de Fragilidade Ambiental (Ross, 1994).Com base nos estudos sobre Fragilidade Ambiental e estrutura fundiária, apresenta-se, aqui, uma reflexão sobre as características ambientais dos territórios destinados às políticas de reforma agrária no Pontal do Paranapanema, evidenciando que forma a apropriação do relevo constitui em elemento relevante no histórico de disputas territoriais na região.

Palavras-chave: Fragilidade Ambiental; Reforma Agrária; Apropriação do Relevo; Pontal do Paranapanema.

RESUMEN

El Pontal do Paranapanema, una región ubicada en el extremo oeste del estado de São Paulo, tiene una compleja historia marcada por conflictos agrarios e intensa transformación ambiental. Desde finales del siglo XIX, las disputas por la tierra y la expansión de la frontera agrícola han moldeado el paisaje local. La supresión de la vegetación nativa, en favor de actividades como el monocultivo de caña de azúcar y la ganadería extensiva, ha agravado problemas como la erosión del suelo. Paralelamente, a finales del siglo XX, la ordenación territorial se reconfiguró con la creación de varios asentamientos rurales. Sin embargo, los estudios demuestran que la distribución de las tierras se basa, entre otros factores, en sus características ambientales, especialmente en su susceptibilidad a los procesos erosivos. Este trabajo busca analizar el patrón de distribución espacial de las tierras del Pontal do Paranapanema en diferentes categorías de tenencia, enfatizando su carácter cualitativo, basándose en el concepto de Fragilidad Ambiental (Ross, 1994). A partir de los estudios sobre Fragilidad Ambiental y estructura agraria, se presenta aquí una reflexión sobre las características ambientales de los territorios destinados a las políticas de reforma agraria en el Pontal do Paranapanema, evidenciando que la forma de apropiación del relieve constituye un elemento relevante en la historia de las disputas territoriales en la región.

Palabras clave: Fragilidad Ambiental; Reforma Agraria; Apropiación del Relieve; Pontal do Paranapanema.

1 INTRODUCTION

The Pontal do Paranapanema region, located in the far west of the state of São Paulo, has historically been marked by a context of land disputes that began in the late 19th century, lasted throughout the 20th century, and continue into the 21st century. On the one hand, the initial land grabbing (*grilagens*) and the origin of the municipalities, stemming from

the expansion of the "Alta Sorocabana" Railroad, set the hegemonic tone for the occupation of the territory, with the installation of extensive peanut, cotton, and pasture crops, and more recently, sugarcane. On the other hand, social movements fighting for land rights still claim today that the State must fulfill judicial decisions, allocating state-owned lands (*terras devolutas*) to rural workers (Leite, 1998; Fernandes, 1999; Feliciano, 2009).

These disputes are responsible for a territorial reconfiguration that occurred mainly in the late 20th and early 21st centuries, resulting in the region having one of the largest concentrations of rural settlements in the state of São Paulo, although many lands are still under dispute.

Beyond the land issues, this territorial arrangement brings environmental consequences, as agricultural practices over time, associated with intense deforestation and the characteristics of the region's soil and relief – which are highly susceptible to erosive processes – also entail problems (Trombeta *et al*, 2014).

These consequences, unevenly distributed according to the qualitative characteristics of the territory, deepen the environmental injustice (Acselrad et al, 2009), which stems from the already consolidated unfair land distribution in Brazil.

Drawing on the concept of Environmental Fragility proposed by Ross (1994), we propose an analysis here of the environmental characteristics of the rural settlements in Pontal do Paranapanema, reflecting on the appropriation of the relief and problematizing the land distribution policy in the region, especially regarding the qualitative aspects of the territory. According to studies by Pimenta (2024), conceptually utilizing the modeling proposed by Ross (1994), the rural settlements exhibited environmental characteristics that were quite distinct from those of the large properties regarding susceptibility to erosive processes.

Thus, it is evident that the concentration of land in Pontal do Paranapanema, beyond the quantitative scope, also manifests in the qualitative sphere, as territories that have already been judged as state-owned land (*devolutos*) in the third instance still remain under the domain of large landowners (*latifundiários*), leaving degraded territories or those highly susceptible to erosion for agrarian reform policies.

2 GENERAL OBJECTIVE

The present work aims to analyze the spatial distribution pattern of lands in the Pontal do Paranapanema across different land tenure categories, emphasizing their qualitative

character, based on the concept of Environmental Fragility (Ross, 1994).

2.1 SPECIFIC OBJECTIVES

- To compare the distribution of different levels of Potential Environmental Fragility among the various land tenure categories, quantifying the proportion of lands highly susceptible to erosion in each of them;
- To identify the environmental condition of the State-Owned Lands (*Terras Devolutas*) (properties under judicial dispute) and compare them with the lands already allocated for agrarian reform (Rural Settlements), analyzing whether the State-Owned Lands present, on average, better environmental conditions (lower levels of fragility);
- To relate the history of territorial occupation in Pontal do Paranapanema, marked by land grabbing (*grilagem*) and the expansion of agribusiness, with the selective appropriation of the relief, demonstrating how the areas of lower fragility (better for mechanization and production) were historically maintained by large landowners (*latifundiários*);
- To discuss the relationship between land concentration in Pontal do Paranapanema and Environmental Fragility, proposing that the land dispute manifests not only in the quantitative scope but, crucially, in the qualitative sphere of the territory.

3 OCCUPATION HISTORY OF PONTAL DO PARANAPANEMA

The large western portion of the state of São Paulo, known as the "Vale do Paranapanema" (Paranapanema Valley), comprised the territory existing between Botucatu and the Paraná River. This territory, designated as "uninhabited lands" (*terras despovoadas*) (Figure 01), began to attract great interest primarily due to the presence of extensive areas of Red Latosol, known locally as "terra roxa" (purple soil). This type of soil is highly fertile, thus sparking great interest given the growing expansion of the coffee economy at the time.

> The quality of these lands attracted coffee planters, but there was great difficulty for human penetration because the indigenous populations, generally hostile, preferred the forest to live in. Hence, the initial incursions were made via the São Paulo tributaries of the Paranapanema: Itapetininga, Guareí, Santo Inácio, Pardo and its tributary, the Turvo, Novo, Pari, Capivara, Jaguaretê, Laranja Doce, Anhumas, or via the Paraná tributaries: Apiaí, Posses, Taquari, Itararé, Cinzas, Santo Inácio, Tibagi, and Pirapó. In

> addition to the rivers, the extensive fields (*campos*) of the Valley also served as a route for penetration and were the first areas occupied due to the lesser resistance offered there by the indigenous people. In the São Paulo part of the Valley, the fields stretched for about, being interrupted only by narrow strips of riparian forests along some watercourses or by the isolated patches of woods (*capões de mato*) that crowned the highest ridges. Finally, the inland foothills of the Serra do Mar, where the Paranapanema originated, and the mountain ranges of Espírito Santo, Fartura, Botucatu, Agudos, and the entire ridge dividing the Paranapanema and Peixe valleys formed the "highlands" of the Valley. These areas, covered in forests, were consequently occupied later due to the challenges posed by the indigenous populations. (Abreu, 1972, p.17)

The occupation of Pontal do Paranapanema has, in its genesis, the land grabbing (*grilagem*) of the lands in the far west of São Paulo, resulting in the establishment of two large farms (*fazendas*): the "Pirapó-Santo Anastácio" and the "Boa Esperança do Água Pehy," belonging to Antônio José de Gouveia and José Teodoro de Souza, respectively (Leite, 1998). The main attraction of these lands was the presence of stretches of the so-called "terra roxa," which exhibited high fertility rates and, thus, generated great interest given the growing coffee economy of the time.

Figure 01 – Map of the Province of São Paulo (1886)

Source: Public Archives of the State of São Paulo.

With the construction of the "Alta Sorocabana" Railroad, the hegemonic model of territorial planning was consolidated, bringing the necessary infrastructure for the flow of

agricultural production (especially coffee), resulting in the founding of several villages that would later transform into the main cities of the region.

> The other extreme of the crescent (of the railway lines) corresponds to the lands situated between the Peixe River and the Paranapanema River. This tip marks the advance of the (coffee) plantations, which in 1905 were distributed from Avaré to Piraju, with some small "islands" a little further west. Two distinct elements can be recognized here: firstly, the coffee plantations located on the terra roxa (purple soil), extending from Óleo to Assis, totaling about 50 million trees, compared to 6 and a half million in 1905; secondly, beyond Assis, deforestation targeted the forests on good calcareous lands of the Bauru sandstone, reaching the last elevations of the ridge, overlooking the Paraná River, in Presidente Venceslau. There are no data prior to the crisis of 1929, but there is an indication that in 1930-1931, 23,500,000 coffee trees were attributed to this region. (Monbeig, 1984, p.187)

The land use in the Pontal do Paranapanema region underwent several transformations over little more than a century. Firstly, coffee plantations played a prominent role in the local economy, but already without the same vigor it had achieved when it first entered the state of São Paulo via the Paraíba Valley.

> With the arrival of the agricultural frontier (1940) in the area of the current municipality of Mirante do Paranapanema, the process of deforestation and agricultural occupation began, based essentially on the cultivation of cotton and peanuts. At that time, the agricultural frontier did not cross the Santo Antônio and Anhumas streams (*ribeirões*), which thus came to delineate two very distinct occupation zones: to the east, an agricultural occupation that caused a very aggressive morphogenesis, resulting in the rapid depletion of the soil, with erosion and silting of the creeks; and to the west of these streams, the semideciduous forest, which only later began to be replaced by pastures (1945–1965), with a characteristic dynamic evolution, differentiated from the former. (Passos, 2004, p.178)

Currently, the region has few forest fragments, with "Morro do Diabo" (Devil's Hill), in Teodoro Sampaio, being the most significant as it constitutes a State Park. Agricultural prominence is currently held by sugarcane and silviculture, in addition to livestock farming (Map 1). Although the sugarcane industry has established itself in many territories previously occupied by pastures, livestock farming still plays a relevant role in the region's economy. According to Santos and Coca (2017), this...

> [...] is mainly due to the characteristics of the soil. The soil is predominantly Latosol, formed from the Bauru Group, which has a high concentration of sand, low natural fertility, good permeability, and excessive drainage (ITESP,

> 1999). These characteristics, combined with the rapid exhaustion of its potential, ended up hindering agricultural practices that increasingly required expensive interventions for planting suitability, in addition to the high susceptibility to erosion due to the soil's natural characteristics, further aggravated by the partial or total removal of vegetation, including the removal of riparian forests along water courses. (Santos; Coca, 2017, p.69)

Therefore, it is observed that the environmental characteristics of the region reserve few areas with sufficient natural resources for agricultural development that does not require excessive investment for compensations related to the infertility stemming from the soil composition.

4 ESTABLISHMENT OF RURAL SETTLEMENTS

To understand the process of establishing the first Rural Settlements, it is necessary to look closely at the first occupations, which occurred in the late 1970s on the Macali farms (RS), in 1979; Primavera (SP), in 1980; Burro Branco (SC) and Gleba XV de Novembro (SP), in 1984 (Mazzini, 2007). Still according to the author, the first experience of land distribution for the Agrarian Reform policy in Pontal do Paranapanema took place through the "Projeto Rebojo," in the municipality of Estrela do Norte-SP, in 1964.

> With the completion of the construction of the three Hydroelectric Power Plants on the Paraná and Paranapanema Rivers, a gigantic number of civil construction workers, mainly those with low schooling and little professional qualification, lost their jobs. This fact, added to the national historical context of rural exodus, conflicts between small landholders (*posseiros*) and farmers (*fazendeiros*), increased social inequality, unemployment in both the countryside and the city, rising inflation, among others, contributed to swell the number of landless families, who saw in the possibility of returning to the countryside chances for survival and development. (Mazzini, 2007, p. 118)

Agrarian Reform policies were implemented in the Pontal do Paranapanema region during the 1980s, during the government of former president José Sarney. According to Feliciano (2009),

> [...] in 1985, after 21 years of military rule, with the inauguration of a civilian president, though indirectly elected, Brazil entered the so-called democratic transition. Vice-President José Sarney assumed the presidency of the "New Republic" due to the death of the then president-elect, Tancredo Neves. José Sarney took on all of Tancredo Neves' commitments regarding the agrarian question. He created MIRAD (Ministry of Agrarian Reform and Development) and chose Nelson Ribeiro as minister, with INCRA (National Institute for

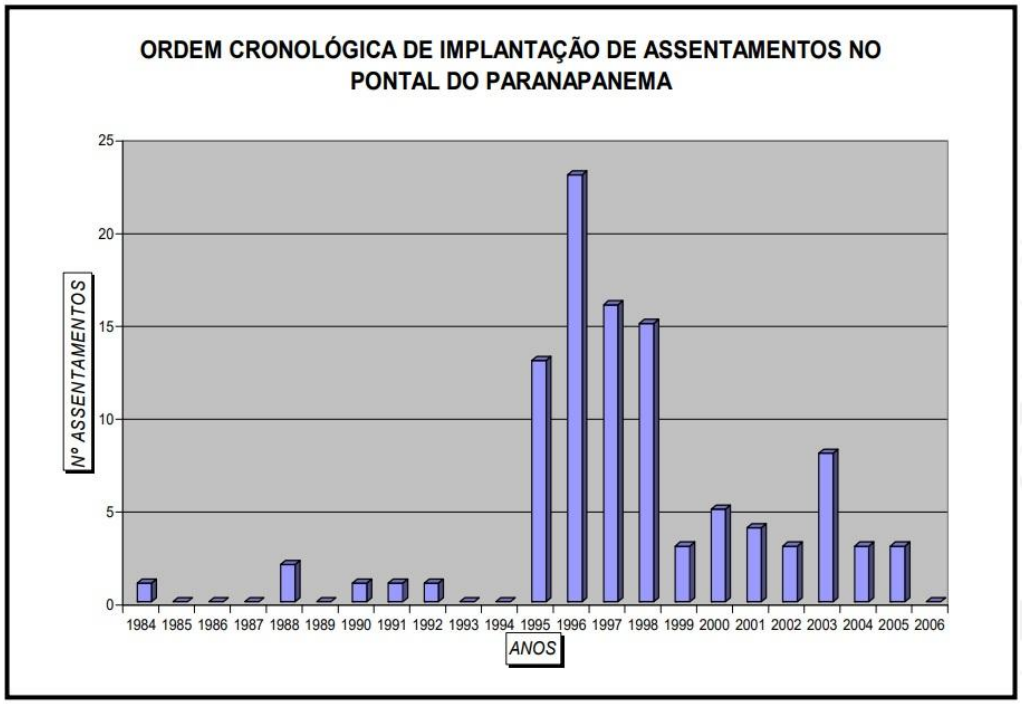
> Colonization and Agrarian Reform) subordinated to it. The president of INCRA at that moment was José Gomes da Silva, an agronomist and a great defender of effective Agrarian Reform. He was, in fact, one of the authors of the Land Statute (*Estatuto da Terra*). The indications that Agrarian Reform would be placed on the political agenda of that government became clear at the IV CONTAG Congress (National Confederation of Agricultural Workers). President José Sarney and the minister attended this congress, presenting a proposal for the elaboration of the 1st National Agrarian Reform Plan (PNRA) of the "New Republic." (Feliciano, 2009, p.75)

In the early 1990s, the municipality of Mirante do Paranapanema-SP was the stage for a large occupation that occurred on the São Bento Farm, involving 247 families. Although the court had decreed the repossession (*reintegração da posse*), the strategy of occupations remained intense in order to pressure the public authorities (Mazzini, 2007).

The establishment of the Settlements intensified in the region starting in the mid-1990s, with the creation of the Government Action Plan for Pontal do Paranapanema (Figure 02). According to the plan,

> [...] it was enacted through the **legitimation** of State-Owned Lands (*áreas devolutas*) smaller than 100 hectares and the **judicial repossession** of State-Owned Lands larger than 500 hectares, dedicating them to the **settlement of landless rural workers**, thus "pacifying" the conflicts that had been escalating since 1990. (ITESP, 1998 *apud* Mazzini, 2007, p.122).

Figure 02 – History of the implementation of Rural Settlements in Pontal do Paranapanema-SP



Source: ITESP Data, 2006. **Org.:** Mazzini, 2007.

Currently, the region has 112 Rural Settlements, distributed across 14 municipalities (Figure 03).

Figure 03 – Rural settlements in Pontal do Paranapanema-SP

Município	Assentamentos	Famílias
Caiuá	08	443
Euclides da Cunha Pta.	09	491
Marabá Pta.	06	255
Martinópolis	02	121
Mirante do Paranapanema	35	1534
Piquerobi	03	83
Pres. Bernardes	08	250
Pres. Epitácio	04	335
Pres. Venceslau	08	369
Rancharia	02	174
Ribeirão dos Índios	01	40
Rosana	04	739
Teodoro Sampaio	21	843
Tupi Paulista	01	31

Source: INCRA, 2017.
Org.: O Autor, 2024.

5 RELIEF: AN OBJECT UNDER DISPUTE

The environmental characteristics of a territory are an important factor when considering attractive elements. This is because the configuration of the soil type or relief, in addition to water availability, entails direct impacts on production, either by altering soil fertility or by the viability of using mechanized production processes.

The environment, according to Coelho (2013), must be understood as a social and historical construction, stemming from the relationship between a society in permanent transformation and the physical space where these transformations occur. Thus, as a basis for social transformations, this environment transforms and is transformed; it conditions and is conditioned by society.

According to Casseti (1995), the "slope" (*vertente*) element, the central object of analysis regarding the relief, has its morphology altered during the process of occupation and the development of activities that materialize the relationship between society and nature. As an essential element to the prevailing mode of production, the slope and the transformations occurring on it are incorporated into the territorial dimension of space, also becoming an object of dispute, considering the conception of territory based on the power relations present in the geographical space (Raffestin, 1993).

The territorial disputes bring with them a series of environmental consequences mainly linked to the different agricultural practices and land use. The intensive use of agrochemicals, the lack of financing for managing lands with ** high susceptibility to erosive processes** are some of the elements that further deepen the unjust nature of land distribution, also materializing as an unfair distribution of the environmental liabilities of such practices.

> The Environmental Justice Movement was constituted in the USA through a creative articulation between social, territorial, environmental, and civil rights struggles. Starting in the late 1960s, a set of conflicts against inadequate sanitation conditions, chemical contamination of residential and work sites, and improper disposal of toxic and hazardous waste was redefined in "environmental" terms. The notion of geographic equity was then invoked as a "referent" to the spatial and local configuration of communities in their proximity to sources of environmental contamination, hazardous facilities, undesirable land uses such as toxic waste dumps, incinerators, sewage treatment plants, refineries, etc. (Acselrad, 2002, p.52)

In Brazil, settlements are classified into 5 categories, according to Bergamasco and Noder (1996):

a) Colonization projects, formulated during the military regime starting in the 1970s, aiming at the occupation of state-owned lands (*áreas devolutas*) and the expansion of the agricultural frontier;

b) Resettlement of populations affected by hydroelectric dam construction;

c) State plans for valuing public lands and possessory regularization;

d) Agrarian reform programs, via expropriation for social interest, based on the Land Statute (1964), partially implemented starting in 1986 under the aegis of the “National Agrarian Reform Plan” (*Plano Nacional de Reforma Agrária*), initiated during the José Sarney government (1985–1989);

e) Creation of extractive reserves for rubber tappers in the Amazon region and other activities related to the utilization of renewable natural resources.

Regarding the Pontal do Paranapanema, Bergamasco and Noder (1996) point out that...

> The land dispute in a discriminatory process (*processo discriminatório*) was also another resource used in the state sphere of government. Through this means, among others, the government began to combat the land grabbing (*grilagem*) of large estates (*latifúndio*), meaning it began to combat the land grabbing of its own lands. (Bergamasco; Noder, 1996, p.29)

The sugar and alcohol production in the Pontal do Paranapanema dates back just over 20 years, to the late 1990s, replacing old areas previously used for livestock farming. These areas, due to their unproductive and irregular nature, were constantly targeted by social movements fighting for land.

Starting in the year 2000, Brazil began to integrate into an international policy for ethanol production due to a severe energy and environmental crisis that was (and still is) plaguing the world as a result of the use of fossil fuels. In light of this, there was a significant increase in the production of the so-called "flex-fuel cars."

> Regarding the importance of water for activating productive ventures, for food production, and for the entire power structure surrounding the interests of capital, the State, and workers, we highlight the Guarani Aquifer. Although it currently has less potential for immediate use, due to the depth at which it is found (which can reach over 1,500 meters), for instance, in the center of the Paraná Basin, and the high cost of drilling wells. It is the third largest in the world, preceded by the Amazon Aquifer (Brazil, Ecuador, Colombia, Venezuela), which covers 4 million há, and the Great Artesian Basin Aquifer (Australia), which covers 1, 7 million ha. The Guarani Aquifer holds approximately 46,000 Km³ of water, covers an area of 1.2 million², of which 840,000 km² is in Brazil, and has a north-south dimension of 2,000 kilometers. It is this subterranean water reserve that the capital involved in different agribusiness activities (sugarcane, soy, corn) is observing closely and is willing to reconcile interests in controlling the best lands and access to water. The essential aspects of this agribusiness expansion process are consolidated territorially, emphatically, across various parts of the space, but we specifically emphasize what is happening in its complex sugarcane expression/composition, which we call the Agro-Hydro-Business Polygon (*Polígono do Agrohidronegócio*) (Thomaz Júnior, 2010, p.94-95).

Thus, the Pontal do Paranapanema assumes a condition that is quite favorable to the expansion of sugarcane production, as it possesses extensive territories with topography highly prone to mechanized activity (flat areas and/or hills with long slopes), and is located over one of the largest aquifers in the world (the Guarani Aquifer).

> [...] The information accumulated through empirical research, combined with the comparison of hiring and termination data for sugarcane workers provided by RAIS/CAGED, allowed us to observe that the mechanization of the sugarcane harvest has expanded significantly in the regions under study. However, this mechanization is not yet total, as it is noted that some municipalities in both regions still show relatively low rates when compared to the regional average. This stems from several factors, such as: i) the slope of the terrain (topography); ii) the level of interest of capitalists in accelerating the accumulation process; iii) the economic and technological potential of the sugarcane plantation owners (mills or suppliers); iv) the productive capacity of the companies processing the raw material, especially those whose municipalities fall within their radius of operation (Barreto, 2018, p.182).

Furthermore,

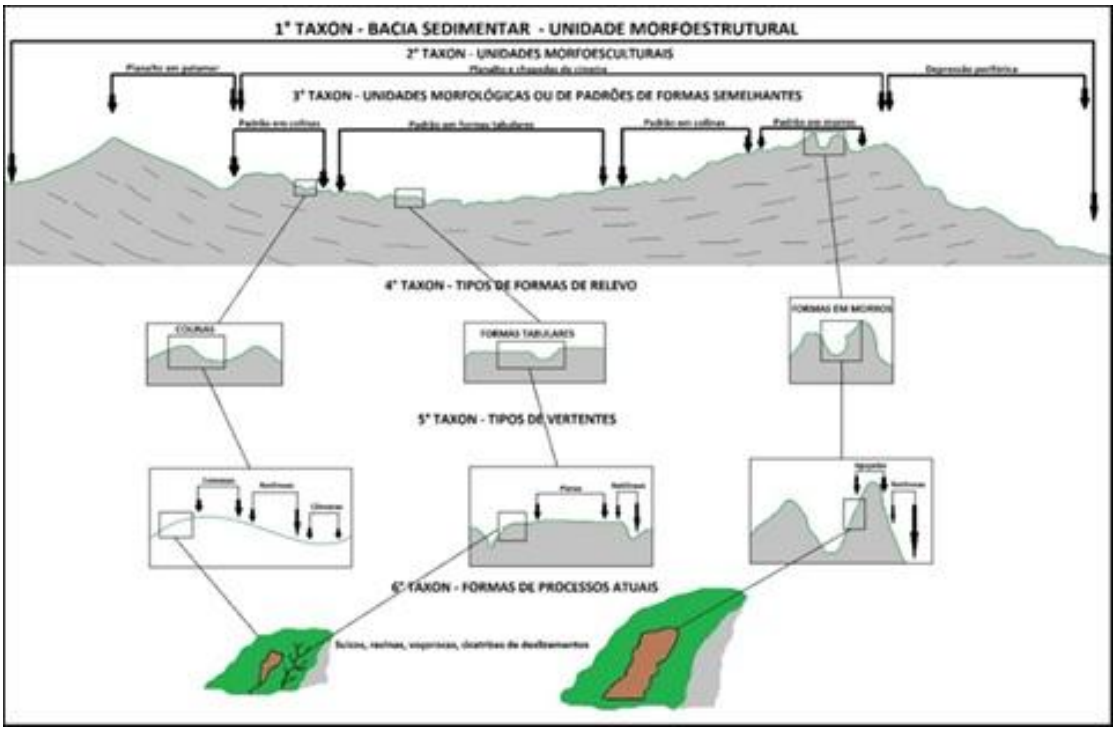
> In the first level, landforms (relief) can either facilitate or impede processes of land occupation, the arrangement of territorial spaces, and production. Their characteristics are important for defining the layouts of highways and railways, the implementation of cities, the construction of airports, dams for hydroelectric power plants, and industrial districts, as well as for defining the most appropriate types of agricultural activities based on the production and transport systems available in each place, and for indicating areas of greatest interest for the preservation and conservation of environmental assets of ecological value (Ross, 2009, p.62-63).

The Pontal do Paranapanema is located in the far West of the state of São Paulo, and its geomorphological composition is inserted within the morphostructure (Ross, 1992) called the "Paraná Sedimentary Basin." (Figure 04)

Accordind to Ross and Moroz (1997),

> The Paraná Sedimentary Basin covers an area of about 1,600,000 km². It represents a complex tectonic depression with an ellipsoidal shape and a major axis running in the NNE-SSW direction. It is embedded in the Precambrian Shield across the Brazilian states of Minas Gerais, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul, as well as Uruguay, Paraguay, and Argentina. Its basement primarily consists of Precambrian crystalline rocks and subordinately of non-fossiliferous Eopaleozoic rocks. This enormous, shallow basin is filled with sediments, mostly continental and some marine, dating from the Upper Silurian, Lower Devonian, Upper Carboniferous, Permian, Triassic, Jurassic (?), and Cretaceous periods, and also contains Mesozoic basaltic lavas (Ross; Moroz, 1997, p. 49).

Figure 04 – Taxonomic proposal for morphostructural and morphosculptural relief units



Source: Ross, 1992.

Regarding morphosculptural characteristics, Ross (2009) points out that:

> Landforms and lithologies are highly diversified. Generally speaking, it can be stated that in the more central parts of the sedimentary basin—both in sedimentary terrains of sandstones and in those of basalt—broad convex-topped hills prevail in the sandstones, while medium-sized ones prevail in the basalts. Near the edges in the higher sections, flat landforms appear, constituting the *chapadas* (Goiás, Triângulo Mineiro, and Mato Grosso), and slightly convex structural surfaces (Paraná, Santa Catarina, and Rio Grande do Sul), alternating between plateau and escarpment forms, especially in southern Paraná, Santa Catarina, and Rio Grande do Sul, where the basalt outcrops (Ross, 2009, p. 76).

In order to more deeply understand the role of environmental characteristics in the territorial disputes in the Pontal do Paranapanema region, we resorted to the Environmental Fragility model proposed by Ross (1994).

6 MATERIALS AND METHODS

As previously stated, the environmental configuration of a territory is a determining element when establishing productive strategies. In other words, environmentally favorable territories become more attractive and, consequently, more disputed, while less favored territories become less interesting.

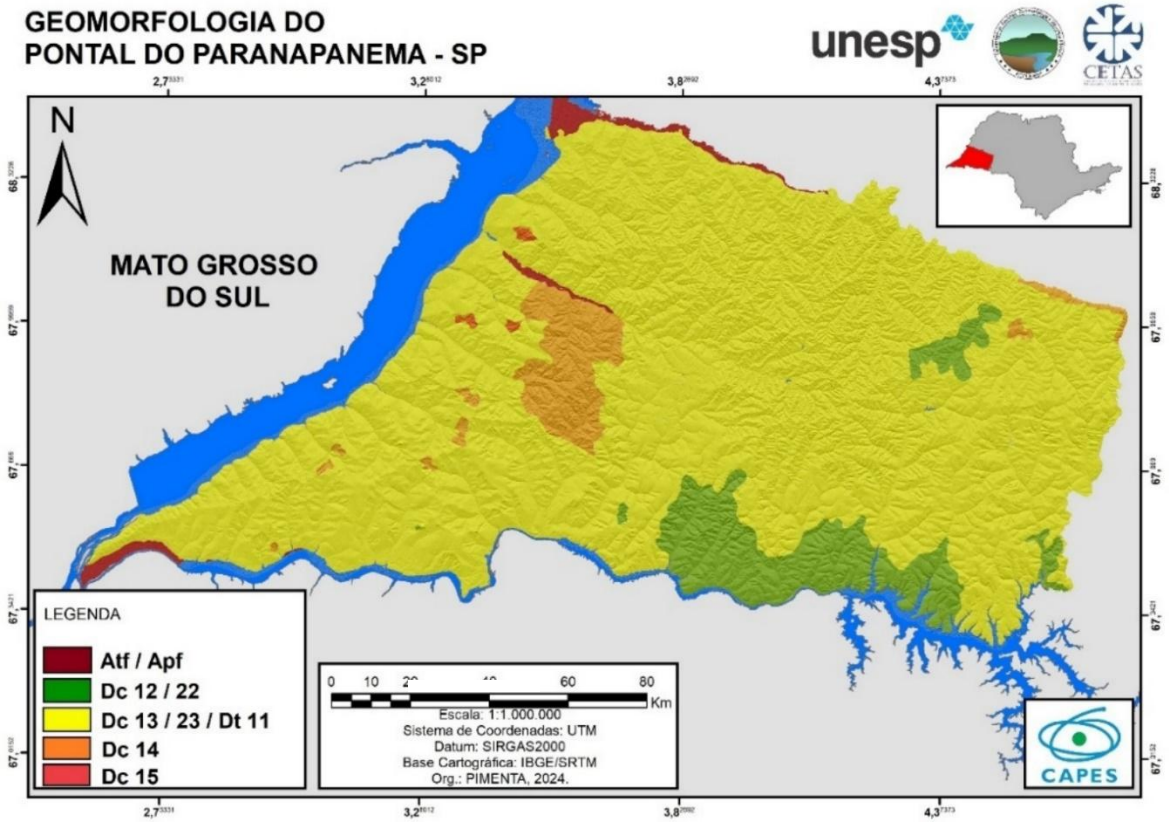
Thus, to understand the role of relief as an element of dispute, mappings regarding Potential Environmental Fragility and the land structure of Pontal do Paranapanema were correlated.

The Environmental Fragility of Anthropized Environments (Ross, 1994) is rooted in the concept of ecodynamics proposed by Tricart (1977). In it, the author assigns values to environmental elements regarding their susceptibility to erosive processes according to the specific characteristics of the type of relief, soil, climate, and land use. Such characterization results in five indices, namely: **Very Low (*Muito Fraco*); Low (*Fraco*); Medium (*Médio*); High (*Forte*); Very High (*Muito Forte*).**

The sequence for producing the cartographic material consists of:

- Selection of the raster image of the Pontal do Paranapanema region;
- Extraction of hypsometry from the DEM (Digital Elevation Model);
- Application of fragility indices for each morphometric category;
- Insertion of fragility data for the different soil types. (Figure 05, Table 01, Figure 06, Table 02).

Figure 05 – Fragility indices for morphometric categories



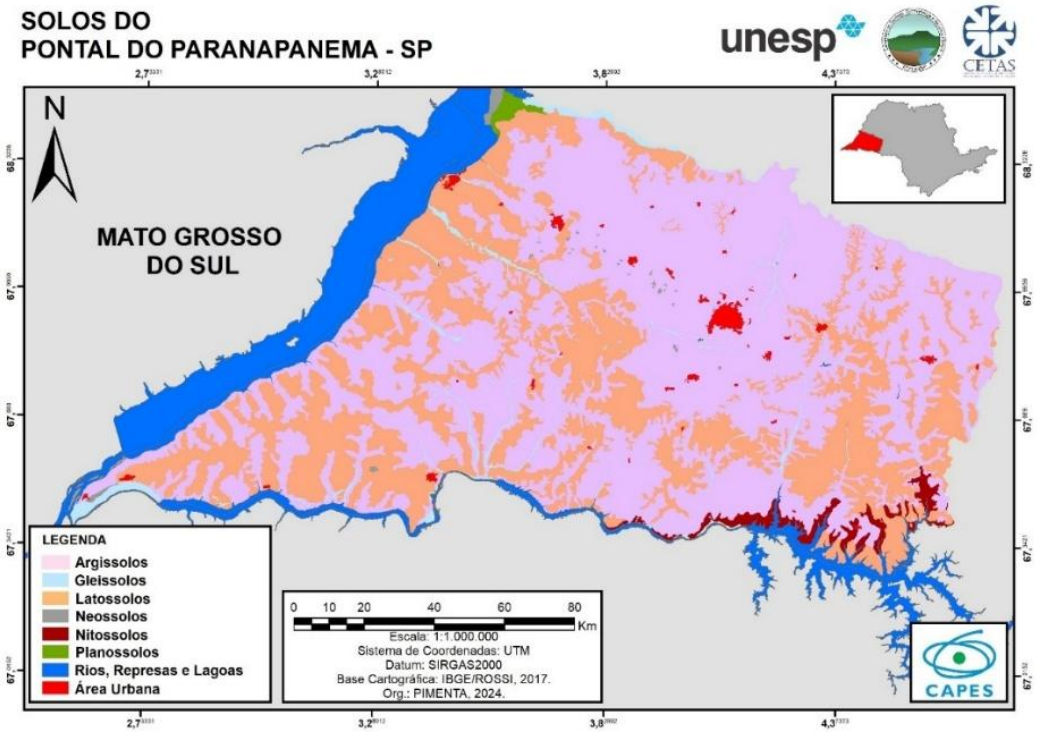
Source: SRTM
Org.: The Author, 2024.

Table 01 – Fragility levels of the morphometric categories of Relief Dissection Indices

Index	Class	Matrix Correspondence
1	Very Low	11
2	Low	12 – 21 – 22
3	Medium	13 – 23 – 31 – 32 - 33
4	High	14 – 24 – 34 – 41 – 42 – 43 - 44
5	Very High	15 - 25 - 35 – 45 – 51 – 52 – 53 – 54 – 55

Sorurce: Ross, 1992.
Org.: The Author, 2024.

Figure 06 – Pedological Map of Pontal do Paranapanema - SP (or: Soil Map of Pontal do Paranapanema - SP)



Source: ROSSI, 2017.
Org.: The Author, 2024.

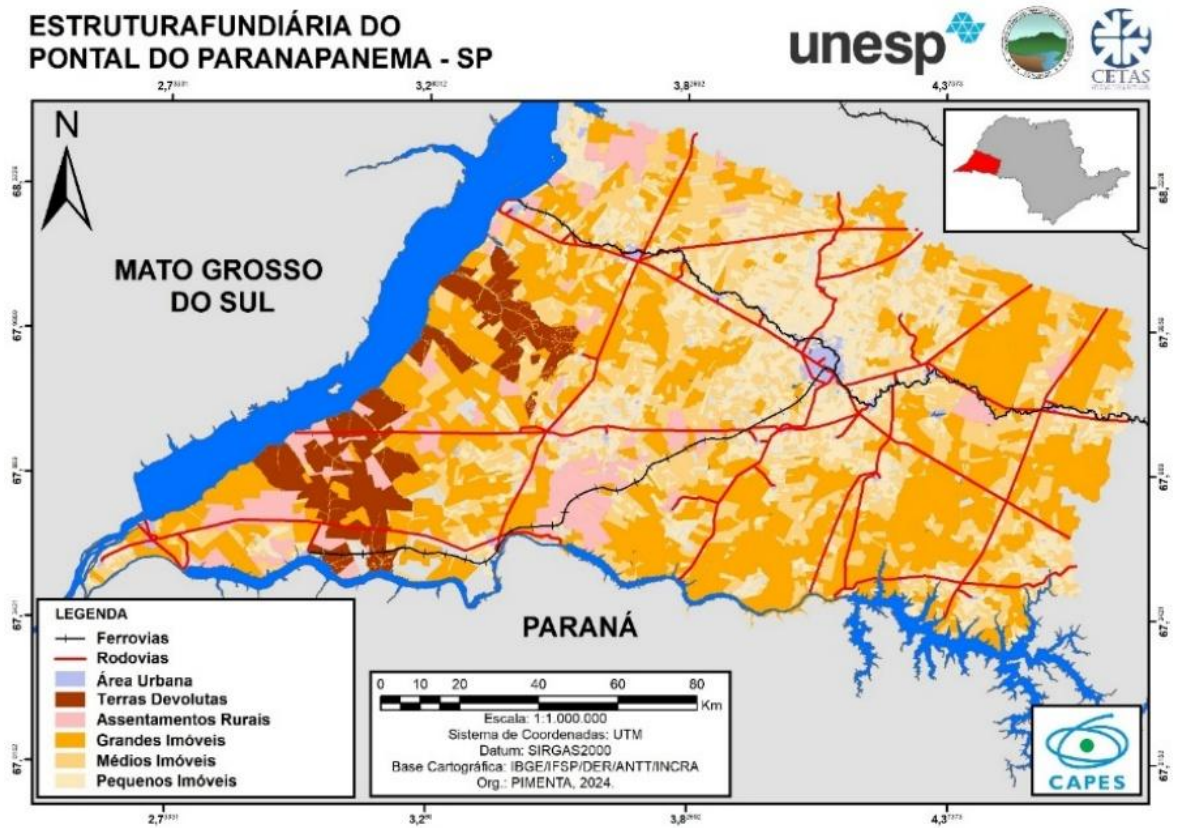
Table 02 – Fragility levels for the "soils" variable in Pontal do Paranapanema - SP

Fragility	Soil type
1 – Very Low	-
2 – Low	Red Latosol
3 – Medium	Red-Yellow Argisol / Red Nitosol
4 – High	Haplic Gleyso / Neosol / Lithic Neosol
5 – Very High	Association of Neosols
Restricted	Association of Planosols and Gleysols

Source: Trombeta; *et al*, 2014.
Org.: The Author, 2024.

In order to establish a correlation with Potential Environmental Fragility, a mapping of the land tenure configuration of Pontal do Paranapanema was also produced, dividing the territory into land categories: Small Properties (*Pequenas Propriedades*), Medium Properties (*Médias Propriedades*), Large Properties (*Grandes Propriedades*), *Terras Devolutas* (vacant lands already ruled in favor of the State in the second or third instance, but still held by large landowners), and Rural Settlements (former Large Estates that were allocated for Agrarian Reform policy) (Figure 07).

Figure 07 – Map of the Land Structure of Pontal do Paranapanema – SP

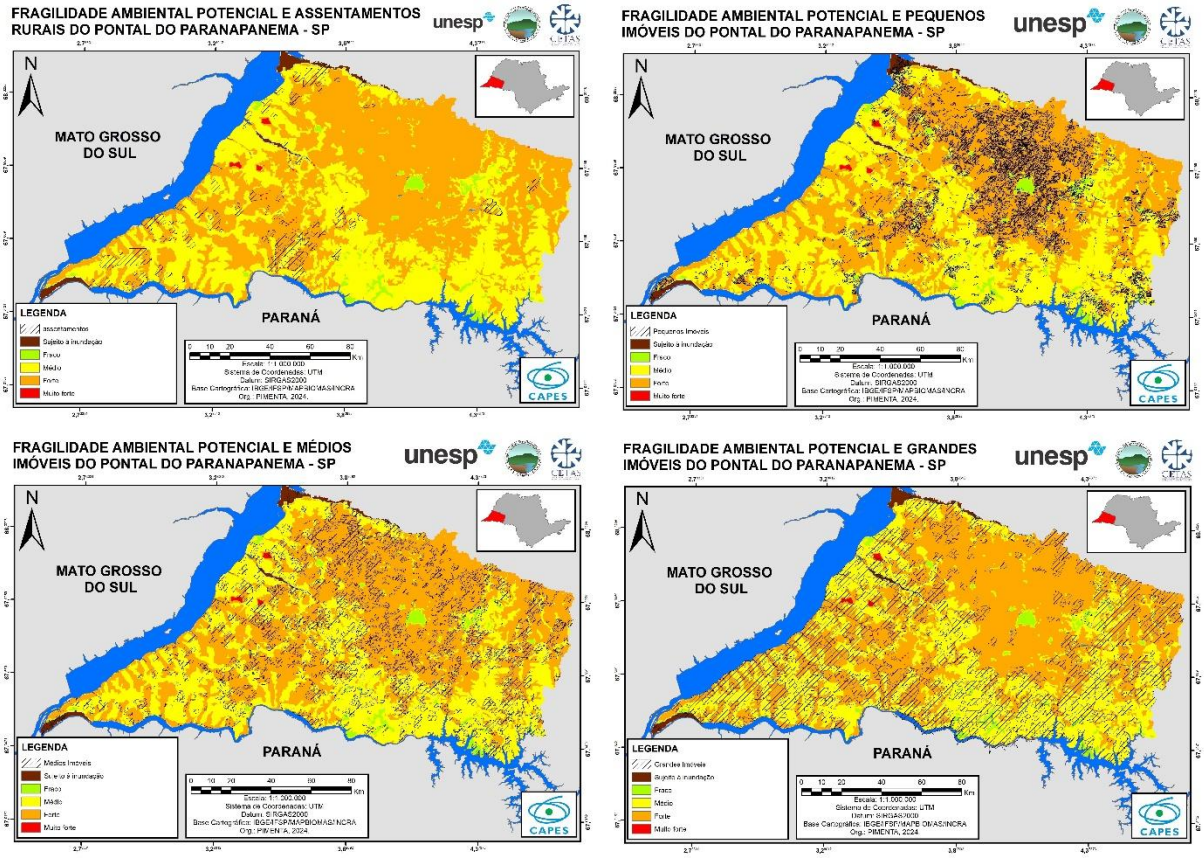


Source: IBGE/INCRA/ANTT/SRTM
Elaboration: The Author, 2024.

7 RESULTS AND DISCUSSION

The Agrarian Reform policy in the Pontal do Paranapanema was a response from the public authorities to various actions in the struggle for land access in the region. However, it also presents contradictions regarding the qualitative nature of the territories allocated for this purpose. This is because, according to the data obtained, settlements were mostly established in areas that are unattractive from an environmental perspective. In other words, these are areas with high Potential Environmental Fragility indices and, therefore, more susceptible to erosive processes. When establishing a correlation between land tenure mapping and Potential Environmental Fragility, the presence of Rural Settlements is evident primarily in territories classified with a HIGH index of Potential Environmental Fragility. (Figure 08)

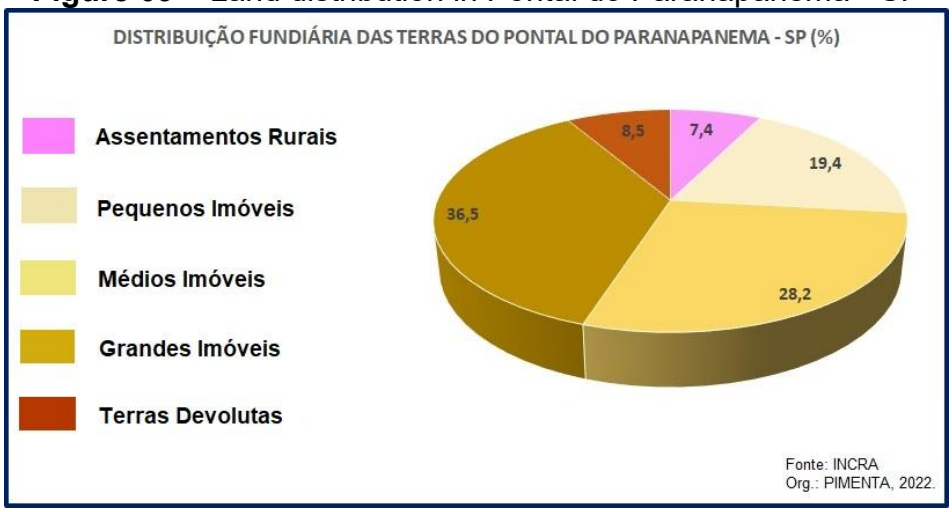
Figure 08 – Potential Environmental Fragility and Land Structure in Pontal do Paranapanema – SP



Source: IBGE/IFSP/MAPBIOMAS/INCRA
Org.: The Author, 2024.

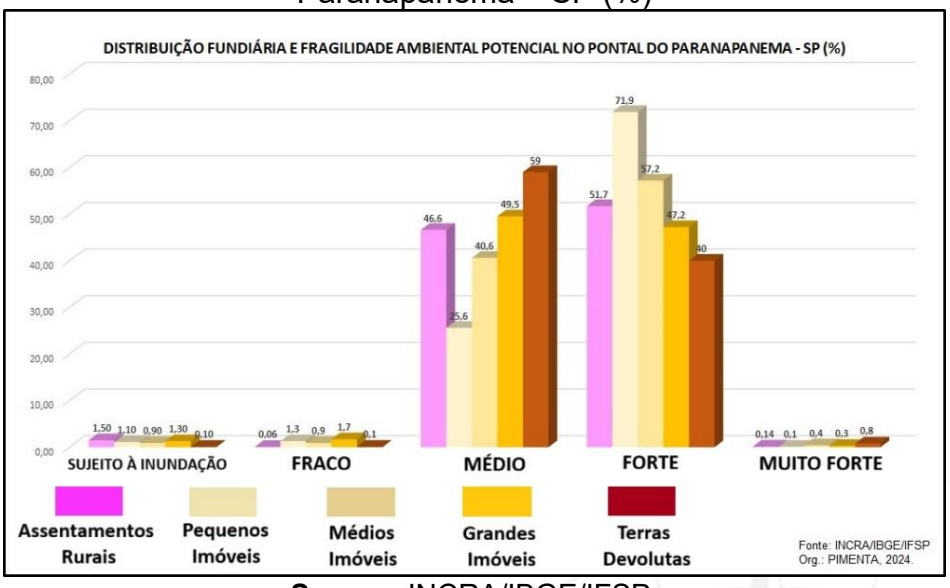
Although Rural Settlements cover only 7.4% of the total territory of Pontal do Paranapanema (Figure 09), this land category concentrates more than half of the lands classified with a HIGH Potential Environmental Fragility index, accounting for 51.7% of the territory (Figure 10). Furthermore, among the categories that present a LOW index (lands less susceptible to erosion), it is the category with the lowest concentration (0.06%).

Figure 09 – Land distribution in Pontal do Paranapanema - SP



Source: SICAR/INCRA.
Elaboration: The Author, 2022.

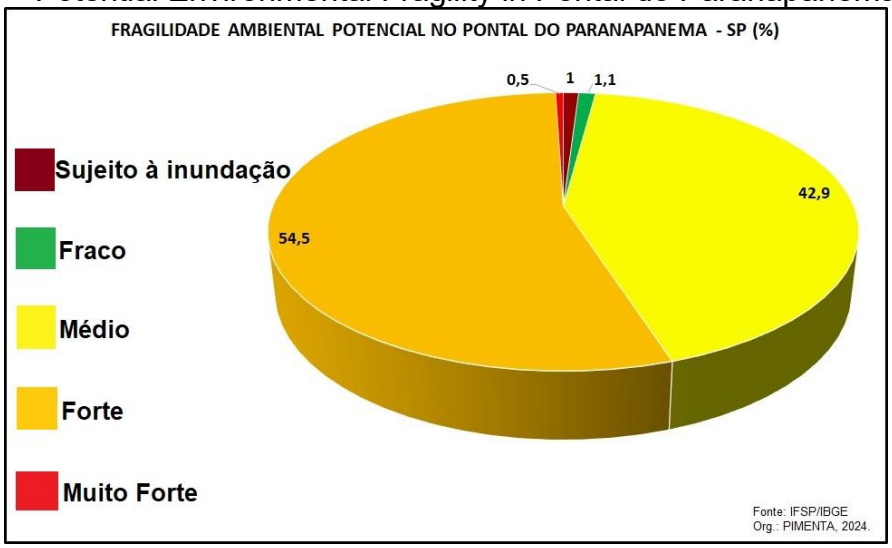
Figure 10 – Land distribution and Potential Environmental Fragility in Pontal do Paranapanema – SP (%)



Source: INCRA/IBGE/IFSP.
Org.: The Author, 2024.

Regarding the categorization of land quality, there is a predominance of territories with MEDIUM (42.9%) and HIGH (54.5%) indices (Figure 11).

Figure 11 – Potential Environmental Fragility in Pontal do Paranapanema – SP (%)



Source: IBGE/IFSP.
Elaboration: The Author, 2024.

The category of Terras Devolutas (territories that should already be complying with judicial rulings and be converted into Rural Settlements), even though it covers only 8.5% of the region's total territory, accounts for more than 59% of the lands with MEDIUM levels of Environmental Fragility. Although the MEDIUM level is not the most ideal among the Potential Environmental Fragility levels, it offers the best conditions when compared to the territory as a whole, as it occupies 42.9% of the land, while the HIGH level occupies 54.5%, and the other levels (VERY LOW, LOW, and VERY HIGH), combined, account for only 2.6% of the Pontal do Paranapanema territory.

8 FINAL CONSIDERATIONS

In countries with historical contexts like Brazil, Agrarian Reform is more than just a policy of social reparation; it is an opportunity for the emancipation of that same society, returning to the rural population the opportunity to live and find fulfillment within it. Movements fighting for land bring together citizens alienated from their right to territory, but the actual number of people in this segment of society is greater than the members of established movements. Many of them are in ghettos, slums, and tenements—urban spaces they occupied following their expulsion from or the impossibility of remaining in rural areas.

The public authorities have a duty to promote Agrarian Reform policy, but the data presented here serve as a reminder that it is also necessary to pay attention to the qualitative

nature of the land. Rural workers have a right to territory, but also to the possibility of producing and to a territory with minimum conditions for occupation.

One cannot ignore the fact that the large landowners who occupied the estates that became Rural Settlements received compensation from the State. Given the condition of these lands, the question arises: was the value of such compensation fair, or was it far above the real value of lands that are so problematic and fragile from an environmental perspective? It is essential that territorial justice and environmental justice become inseparable in the pursuit of repairing the historical inequalities of Brazilian society.

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