



THE SOCIAL FUNCTION OF RURAL PROPERTY: NEW LEGAL CHALLENGES IN THE FACE OF DIGITAL LAND GRABBING

A FUNÇÃO SOCIAL DA PROPRIEDADE RURAL: NOVOS DESAFIOS JURÍDICOS FRENTE À GRILAGEM DIGITAL DE TERRAS

LA FUNCIÓN SOCIAL DE LA PROPIEDAD RURAL: NUEVOS DESAFÍOS JURÍDICOS ANTE EL ACAPARAMIENTO DIGITAL DE TIERRAS

JULIA ROBERTA PEREIRA CAMPOS¹
KARLA KAROLINE RODRIGUES SILVA²

ABSTRACT

The objective of this scientific article is to analyze the irregular appropriation of Brazilian lands, one of Brazil's major historical challenges, marked by land concentration, the fragility of records, and the persistence of illegal land grabbing (grilagem). Since the colonial period, the absence of an effective agrarian policy has consolidated inequality in land access, favoring illicit practices of document falsification to legitimize irregular possessions. Thus, the lack of a fair land distribution and the irregular appropriation have worsened over time. This research, qualitative in nature and based on the deductive method, begins by analyzing constitutional and infra-constitutional norms, especially the social function of property provided for in article 5, XXIII, and article 186 of the Federal Constitution, contrasting them

¹ Graduanda em Direito pela Facunicamps. Atualmente é estagiária - analista de Cálculo Judicial da Procuradoria Geral do Estado de Goiás. Tem experiência na área de Direito. E-mail de contato: jr9255445@gmail.com. CV: <http://lattes.cnpq.br/7671468890304201>.

² Doutoranda e Mestra em Direito Agrário pela Universidade Federal de Goiás, na linha de pesquisa Fundamentos Jurídicos da Propriedade e da Posse, Conflitos Emergentes e Sistemas de Justiça. Pós-graduada em Direito Constitucional pelo Instituto Brasiliense de Direito Público (2015-2017); Direito Civil e Processual Civil pela FCV (2018-2019) e Direito Administrativo pela FCV (2018-2019). Graduada em Direito pela Pontifícia Universidade Católica de Goiás (2010 - 2015). Bolsista do Programa Universidade para Todos (ProUni). Atualmente é membra do Projeto de Extensão Observatório da Justiça Agrária vinculado ao Programa de Pós - Graduação em Direito Agrário da Universidade Federal de Goiás. É assistente de Desembargador no Tribunal de Justiça do Estado de Goiás (TJ/GO). Professora Universitária do curso de Direito na Faculdade FACUNICAMPS. Autora do livro: "Massacres e conflitos agrários na região de fronteira do Brasil: uma análise a partir da criminologia crítica entre o período entre 1985 a 2022", pela Editora Mondru. E-mail de contato: karla.s.rodrigues@hotmail.com.. CV: <http://lattes.cnpq.br/0263998330001002>. ORCID: <https://orcid.org/0000-0001-5377-872X>.

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CAMPOS, Julia Roberta Pereira; SILVA, Karla Karoline Rodrigues;

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with the practices of traditional illegal land grabbing and, more recently, with the so-called "digital land grabbing" or "digital grilagem." Digital land grabbing refers to the electronic manipulation and falsification of data in public registry systems, which poses a new challenge to agrarian and environmental law. Therefore, the research shows that the irregular appropriation of land, in any of its forms, compromises the social function of property, undermines agrarian justice, and increases conflicts in rural areas. Not only that, but the use of artificial intelligence, integrated with efficient public policies, is also proving essential to safeguard legality, promote the equitable distribution of land, and ensure the effectiveness of the social function, a central pillar of the Brazilian agrarian legal system.

Keywords: Irregular Appropriation. Digital Land Grabbing. Social Function of Land. Illicit Practices and Artificial Intelligence.

RESUMO

O objetivo do presente artigo científico é analisar a apropriação irregular das terras brasileiras, sendo um dos maiores desafios históricos do Brasil, marcada pela concentração fundiária, pela fragilidade dos registros e pela persistência da grilagem. Desde o período colonial, a ausência de uma política agrária efetiva consolidou a desigualdade no acesso à terra, favorecendo práticas ilícitas de falsificação documental para legitimar posses irregulares. Desse modo, a falta de distribuição de terras, de forma justa, e a apropriação irregular foram agravadas ao longo do tempo. A presente pesquisa, de natureza qualitativa e fundamentada pelo método dedutivo, parte da análise das normas constitucionais e infraconstitucionais, em especial a função social da propriedade prevista no artigo 5º, XXIII, e no artigo 186 da Constituição Federal, confrontando-as com as práticas da grilagem tradicional e, mais recentemente, com a denominada "grilagem digital". A grilagem digital refere-se à manipulação e falsificação eletrônica de dados nos sistemas públicos de registros, o que demonstra um novo desafio ao direito agrário e ambiental. Portanto, a pesquisa evidencia que a apropriação irregular de terras, em qualquer de suas modalidades, compromete a função social da propriedade, prejudica a justiça agrária e amplia conflitos no meio rural. Não somente isso, como também, a utilização da inteligência artificial, integrada a políticas públicas eficientes, mostra-se essencial para resguardar a legalidade, promover a distribuição equitativa da terra e assegurar a efetividade da função social, pilar central do ordenamento jurídico agrário brasileiro.

Palavras-chave: Apropriação Irregular. Grilagem Digital. Função Social da Terra. Práticas Ilícitas e Inteligência Artificial.

RESUMEN

El objetivo del presente artículo científico es analizar la apropiación irregular de tierras brasileñas, siendo uno de los mayores desafíos históricos de Brasil, marcada por la concentración de la tierra, la fragilidad de los registros y la persistencia del acaparamiento ilegal de tierras (grilagem). Desde el período colonial, la ausencia de una política agraria efectiva consolidó la desigualdad en el acceso a la tierra, favoreciendo prácticas ilícitas de falsificación documental para legitimar posesiones irregulares. De este modo, la falta de una distribución justa de tierras y la apropiación irregular se agravaron a lo largo del tiempo. La presente investigación, de naturaleza cualitativa y fundamentada en el método deductivo, parte del análisis de las normas constitucionales e infraconstitucionales, en especial la función social de la propiedad prevista en el artículo 5º, XXIII, y en el artículo 186 de la Constitución Federal, confrontándolas con las prácticas del acaparamiento ilegal de tierras tradicional y, más recientemente, con el denominado "acaparamiento ilegal de tierras digital" o "grilagem digital". El acaparamiento ilegal de tierras digital se refiere a la manipulación y falsificación electrónica de datos en los sistemas públicos de registros, lo que demuestra un nuevo desafío para el

derecho agrario y ambiental. Por lo tanto, la investigación evidencia que la apropiación irregular de tierras, en cualquiera de sus modalidades, compromete la función social de la propiedad, perjudica la justicia agraria y amplía los conflictos en el medio rural. No solo eso, sino que también, la utilización de la inteligencia artificial, integrada a políticas públicas eficientes, se muestra esencial para salvaguardar la legalidad, promover la distribución equitativa de la tierra y asegurar la efectividad de la función social, pilar central del ordenamiento jurídico agrario brasileño.

Palabras clave: Apropiación Irregular. Acaparamiento Digital de Tierras. Función Social de la Tierra. Prácticas Ilegales e Inteligencia Artificial.

INTRODUCTION

Rural property in Brazil has, throughout its history, been a central theme in discussions on economic development, social justice, and environmental preservation. In this way, a right initially absolute, inherited from the colonial period, has evolved into a concept that incorporates the social function, a constitutional principle that subordinates the individual interest of the owner to the collective interests of society. This transformation, consolidated in the 1988 Federal Constitution and detailed in various laws, seeks to ensure that land fulfills its productive, environmental, and social role, combating land concentration and promoting human dignity in the countryside.

However, the challenges for the effective realization of the social function of rural property are constant and renew themselves with technological advancement. In this sense, the emergence of "digital land grabbing" represents a new and sophisticated threat to legal security and land governance. Thus, using digital tools such as the Rural Environmental Registry (CAR - Cadastro Ambiental Rural) and geospatial data, criminals manage to fraudulently register and illegally appropriate vast extensions of public lands, conservation units, and territories of traditional communities. From this perspective, this practice not only violates the legitimate right to property but also intensifies agrarian conflicts, drives deforestation and environmental degradation, and perpetuates social exclusion in the countryside.

Given this complex scenario, blockchain technology emerges as a potential tool to *combat* digital land grabbing, due to its characteristics of immutability, transparency, and decentralization. Therefore, the implementation of this technology in the Brazilian legal context requires an in-depth analysis of its compatibility with existing legislation and the regulatory, technical, and social challenges that need to be overcome.

Thus, the research problem is to understand how digital land grabbing impacts the realization of the social function of rural property in Brazil and what are the legal challenges and opportunities for promoting more secure and transparent land regularization. Furthermore, the general objective is

to analyze the legal challenges posed by digital land grabbing to the social function of rural property in Brazil, aiming to promote legal security and social justice. In addition, the specific objectives are to understand the Brazilian land structure, the concept of traditional and digital land grabbing, and how this legally affects the social function of land.

The methodology used to achieve the proposed objectives for this article involved bibliographic research with authors such as Arnaldo Rizzato and Nelson Malzoni. In addition, consultation was made to specialized scientific databases, such as SciELO. In this sense, the method used is based on deductive reasoning, moving from general concepts to specific analyses. Furthermore, bibliographic research was applied to substantiate the problem identified in this article. The type of research carried out was Qualitative Research.

1 BRAZILIAN LAND STRUCTURE AND LAND GRABBING

Since the colonial period, the distribution and use of land have been marked by a concentration model that perpetuated inequalities and directly influenced social and economic relations in Brazil, as the roots of this concentration can initially be traced to the territorial organization implemented by the Portuguese Crown.

Thus, the hereditary captaincies were instituted in the 16th century as a strategy of the Portuguese Crown to promote the occupation and economic exploitation of Brazilian territory. Through this system, the *Sesmarias* regime was created, that is, vast areas granted to grantees who held full powers over their lands, including rights of possession, administration, and hereditary transmission. In this sense, the *sesmarias* regime further intensified land concentration by distributing large extensions to few beneficiaries under the pretext of stimulating agricultural production.

With Brazil's independence and the abolition of slavery, the land issue gained new nuances. Consequently, the 1850 Land Law was created to regulate land possession and property, establishing that from that moment on, land could only be acquired through purchase and sale, and no longer by donation or possession. This measure, which aimed to formalize property and curb land grabbing, in practice made access to land even more difficult for former slaves and the poorer population, who lacked the resources to buy it. Thus, the 1850 Land Law consolidated latifundia, land grabbing, and land concentration as structural characteristics of Brazilian society, preventing the formation of a class of small rural landowners and maintaining the hegemony of agrarian elites.

The proclamation of the Republic and the various subsequent constitutions brought discussions about the need for agrarian reform and the social function of property. However, it was

only with the Land Statute in 1964 that the concept of the social function of land was formally introduced into Brazilian legislation. Therefore, the Land Statute established that rural property must fulfill its social function, i.e., be productive, respect labor and environmental laws, and promote social well-being. The law provided for the expropriation of lands that did not fulfill this function, with compensation in agrarian debt bonds, for agrarian reform purposes.

In 1988, with the promulgation of the Federal Constitution, known as the "Citizen Constitution," the principle of the social function of property was reinforced, making it a fundamental right and one of the pillars of the economic and social order. In view of this, Article 186 of the Federal Constitution details the requirements for rural property to fulfill its social function, including rational and adequate use, proper use of available natural resources and environmental preservation, observance of provisions regulating labor relations, and exploitation that favors the well-being of owners and workers. Thus, expropriation for agrarian reform purposes, based on non-compliance with the social function, is an instrument provided to promote the fair distribution of land.

However, Brazilian land history is intrinsically linked to land grabbing (*grilagem*), a practice dating back to the early days of colonization and perpetuated to the present day, adapting to new technological realities. In this way, the practice of land grabbing, once characterized by the falsification of physical documents and rural violence, evolved into the digital sphere, using electronic systems to legitimize land possession illicitly. Therefore, this evolution of land grabbing, from a rudimentary practice to a sophisticated digital fraud, demonstrates the persistence of a historical problem that adapts to new technologies to continue promoting land concentration and illegality.

Continuing with the development of the social function of land, initially, the concept of property was markedly individualistic and absolute, reflecting the influences of Roman law and colonization policies that privileged the appropriation of vast land extensions. However, over the centuries, this conception was gradually transformed, culminating in the incorporation of the principle of social function as one of the pillars of the Brazilian legal system (Assis, 2008).

Thus, the beginning of the principle of the social function of land came with the 1916 Civil Code (Federal Law No. 3,071), which consolidated absolute private property, in line with the legal liberalism of the time. Consequently, the owner held the rights to use, enjoy, and dispose of the asset in an almost unrestricted manner. With this, the acquisition of property was formalized by the transcription of the title in the property registry, accession, adverse possession, and hereditary right, without major concerns about the social or environmental impact of land use.

Given the lack of concern about the social or environmental impact, the 1934 Federal Constitution introduced the social function of property into the Brazilian legal system. This milestone

represented a break with the purely individualistic view, establishing that the exercise of the right to property should be in harmony with the interests of the collectivity. Thus, expropriation by the Public Authorities, regulated later by Decree-Law No. 3,365 of 1941, became an instrument to ensure the fulfillment of this function. Furthermore, the 1934 Constitution included adverse possession based on labor (*usucapião pró-labore*), valuing work as a requirement for acquiring ownership, a concept that would be deepened by the Land Statute.

Moreover, the Land Statute (Law No. 4,504/64) listed the social function of rural property as a fundamental principle of Agrarian Law, in its Art. 2, § 1. The 1988 Federal Constitution elevated the social function of property to the category of a fundamental principle, consolidating it as one of the pillars of the Democratic Rule of Law.

Land grabbing (*grilagem*) is an ancient practice in Brazil and, according to documentation from the National Confederation of Agricultural Workers (CONTAG), the denomination derives from the custom of using crickets (*grilos*) to age the falsified documents of acquired lands. Land grabbing can be characterized in various ways, such as promoting the appropriation and exploitation of massive areas of land, usually public lands (*devolutas*), by individuals or companies, without legal recognition through purchase, donation, or concession by the Public Authorities, and driven not only by private interests but also by the interests of national and international economic groups (Contag, 2021).

According to the jurist and legal scholar, Arnaldo Rizzato, land grabbing corresponds to the fraudulent practice of acquiring rural properties through falsification of documents or simulation of legal transactions, seeking to legitimize illegal possession. This phenomenon, with historical roots, was aggravated by the fragility of the property registration system and the absence of effective land inspection (Rizzato, 2024).

However, land grabbing does not materialize only through falsified documents, but also when it is carried out simply by the temporal connection to land possession. In this sense, the classification of improper land occupation is adopted, which encompasses all occupations not recognized by the State. This distinction serves for studies where land possession grounds the rights and duties of the parties involved, preceding the question of the legality of the documentation (Ipam, 2024).

The practices of devastation of the Amazon rainforests are frequently associated with land grabbing, an activity oriented towards personal benefit through the falsification of information to obtain legal property. During Brazil's formation, land grabbing was a serious problem that led to the creation of laws like Decree No. 9,760/46. In regions such as Pará, Rondônia, Acre, and Mato Grosso,

rich in natural resources, one can observe the concentration of land in the hands of companies and few rural landowners. This concentration generates violence and disorderly deforestation, characterizing the Brazilian State as negligent. According to the coordinator, Rodrigo Jorge, of the Chico Mendes Institute for Biodiversity Conservation (ICMBio), in 2023 about 20% of the Amazon was devastated, including protected areas and indigenous lands (Agência Senado, 2023)

Evidently, the act of grabbing land is illegal, causing very serious problems for specific localities; it also enables the illegal occupation of public places, a social issue whose resolution depends on government policies for land disputes. From this perspective, the Land Statute is the ideal instrument to punish those responsible and regularize property, both for large companies and family farmers. The practice of land grabbing combines the falsification of documents with the improper and illegal appropriation of third-party lands, especially in rural areas (Uol, 2023).

The illegal activities of land grabbing have caused various social damages in the places where they are installed, such as the violation of the rights of local communities, the displacement of traditional families, disrespect for public areas, and the impossibility of public access to deforested areas.

Furthermore, the scholar Nelson Malzoni highlights that land grabbing cannot be seen only as document fraud, but as a mechanism for perpetuating social inequalities in the countryside, as it impedes the democratization of access to land. Thus, land grabbing affects not only the right to property but also compromises agrarian development and social pacification (Malzoni, 2025).

Land grabbing, even inserted within a cultural and historical context of the occupation of large rural areas, currently cannot be considered a socially correct practice, as it generates serious atrocities against nature, people living in rural areas, and specifically, in the regions of greatest violence and poverty in Brazil. No matter how much Brazilian legislation allows a certain type of action in rural areas, the social function of land must be capable of preventing that which offers wealth only for an individual to the detriment of a large mass of people who also need to enjoy the lands (Transparência Internacional, 2021).

The social responsibility of business organizations and society itself is of great importance in the process of combating and eradicating land grabbing in the country, so that it cannot be conceived only as a governmental issue, because, without inspection and social mobilization, the effects of land grabbing will remain as serious social and environmental problems not only in the regions of Brazil that still have large rural areas but throughout the country (Transparência Internacional, 2021).

2 DIGITAL LAND GRABBING

As mentioned previously, land grabbing (*grilagem*), historically, consists of the illegal appropriation of land, often through document forgery and violence. Consequently, the term harks back to the practice of aging false documents in boxes with crickets (*grilos*) to give them an appearance of authenticity. Currently, this practice has evolved into the digital sphere, taking advantage of vulnerabilities and the lack of oversight in electronic land registration and cadastre systems.

In this way, digital land grabbing manifests itself, for example, through the improper use of the Rural Environmental Registry (CAR - *Cadastro Ambiental Rural*), a system that allows individuals to declare data themselves, in order to map environmental information of rural properties. In view of this, land grabbers (*grileiros*) insert false data into the CAR, illegally registering vast areas, including public and indigenous lands, as if they were private properties. Although registration in the CAR does not confer property rights, it generates an official document that can be used to simulate possession, thereby obtaining financing and even justifying deforestation and illegal economic exploitation (Ciência Hoje, 2023).

Therefore, this new form of land grabbing is particularly dangerous due to its speed and scale, since the ease of access and manipulation of data on digital platforms allows large land areas to be "grabbed" in a short time, making identification and repression by supervisory agencies difficult. Another point is the delay in analyzing and validating registrations, coupled with the complexity of land legislation, creates an environment conducive to the proliferation of these frauds, with serious environmental, social, and economic consequences, especially in the Amazon (Estadão, 2023).

The proliferation of these frauds, as a criminal practice, culminates in the irregular appropriation of forest areas, promoting deforestation, ecosystem destruction, and violence against traditional communities. In this way, the camouflage of illegal transactions and the creation of false documentation, through blockchain, drives the irregular appropriation of lands (Estadão, 2023).

Blockchain technology is known for its ability to create secure and immutable records, through a chain of encrypted data blocks that are complex to alter. From this perspective, blockchain should be a tool to ensure the security of legitimate transactions; however, it is used in digital land grabbing as a "parallel notary" in the virtual world. In this way, criminals use this technology to fraudulently register land possession, creating a transaction history that, at first glance, appears legitimate (Figueiredo, 2020).

Therefore, the adoption of blockchain by land grabbing creates a complex problem for authorities, as immutability prevents false records from being erased, not allowing the transaction to be annulled even if the fraud is discovered. Moreover, the absence of specific regulation for land transactions using blockchain allows criminals to operate in a gray area where current legislation cannot act effectively (Figueiredo, 2020).

Thus, blockchain has the potential to be a tool for good, yet it is manipulated to give a false appearance of legality to criminal transactions, making tracking and inspection even more challenging (Figueiredo, 2020).

3 LEGAL CHALLENGES IN COMBATING DIGITAL LAND GRABBING

Despite legislative advances, land grabbing (grilagem) has remained a persistent practice in Brazilian land history, adapting and evolving with new realities. The practice of land grabbing, previously characterized by the forgery of physical documents and rural violence, evolved into the digital sphere, using electronic systems to legitimize land possession illicitly. This transition represents an even greater challenge for authorities, as fraud becomes harder to track and combat, requiring new tools and strategies for inspection and investigation. Globalization and data interconnection also facilitate the action of organized criminal groups, which operate on various fronts to legitimize their illegal possessions.

The emergence of "digital land grabbing" represents a new and sophisticated threat to legal security and land governance. Using digital tools such as the Rural Environmental Registry (CAR) and geospatial data, criminals manage to fraudulently register and illegally appropriate vast extensions of public lands, conservation units, and territories of traditional communities. This practice not only violates the legitimate right to property but also intensifies agrarian conflicts, drives deforestation and environmental degradation, and perpetuates social exclusion in the countryside. The ease of data manipulation in digital environments, the complexity of systems, and the lack of adequate inspection create fertile ground for the actions of digital land grabbers (grileiros digitais), who take advantage of the slowness and bureaucracy of traditional systems to consolidate their frauds, often with the complicity of corrupt public officials. The lack of interoperability between different registries and registration systems also hinders the identification of fraud and the action of control agencies.

The role of the Judiciary is multifaceted. Regarding its jurisdictional function, it is responsible for adjudicating lawsuits involving land conflicts, applying the law to concrete situations. This includes possessory actions, which are crucial instruments for guaranteeing the collective

possession of traditional peoples and communities, often victims of land grabbing. However, the low conviction rate in land grabbing cases in the Amazon (only 7%) reveals the difficulty of proving the crime and the impunity that often prevails, discouraging reporting and the realization of justice (Climate Policy Initiative, 2023).

In the administrative sphere, the Judiciary, through its inspectorates (corregedorias), has the competence to inspect and control the activities of real estate registry offices (cartórios de registro de imóveis). This inspection is vital to ensure the legality and security of transactions and legal documents. In view of this, issuing guidelines, conducting inspections, and regulating registry practices are important mechanisms to curb the participation, conscious or unconscious, of registry officials in digital land grabbing schemes (Climate Policy Initiative, 2023).

According to the scholar, Fernando Pereira Sodero, a central figure in Brazilian Agrarian Law, known for his participation in drafting the Land Statute (Law No. 4,504/64) and for his deep analysis of the social function of property, argues that the legal regime of land is based on the doctrine of the social function of property, whereby the right to property is not absolute but must meet the interests of the collectivity, food production, and environmental preservation.

In this sense, the Land Statute (Law No. 4,504, of November 30, 1964) is the main legal milestone of Brazilian agrarian policy. From this perspective, its primary objective is to promote agrarian reform and sustainable rural development, seeking the fair distribution of land and the fulfillment of its social function. Thus, one of the pillars of the Statute is the principle of the social function of property, which conditions the right of property to its productive use and the observance of social and environmental criteria. Therefore, property must favor the well-being of owners and workers, maintain satisfactory productivity levels, ensure the conservation of natural resources, and respect labor relations. As a result of non-compliance with the social function, expropriation for agrarian reform purposes may occur, carried out by INCRA.

In the context of digital land grabbing, the Land Statute faces significant challenges, since the illegal appropriation of land, facilitated by digital means, subverts the objectives of agrarian reform and land regularization. The absence of a robust and integrated registration system, capable of validating data authenticity and curbing fraud in real time, weakens the application of the Statute's norms. Digital land grabbing, by creating false legitimacy over improperly occupied lands, makes it difficult to identify the true owners and implement land regularization policies. This represents a direct violation of the principle of social function, as the illegal appropriation of land prevents the fulfillment of this principle inherent to rural property, generating conflicts and social and environmental imbalances.

4 LEGAL ANALYSIS

The analysis of irregular land appropriation and, especially, of digital land grabbing, must be carried out considering the Brazilian legal system, which enshrines the social function of property as a structuring principle of the economic and social order. Article 5, XXIII, of the 1988 Federal Constitution provides that "property shall fulfill its social function," a principle complemented by Article 186 of the CRFB/88, which establishes four essential requirements: rational and adequate use; proper use of natural resources and environmental preservation; observance of labor laws; and exploitation that favors the well-being of owners and workers. Thus, the social function is not a mere legal ornament but a condition for the validity of the right to property itself.

In the infraconstitutional field, the Land Statute (Law No. 4,504/1964) reinforces this guideline by conditioning the legitimacy of rural property to the fulfillment of its social function, defining land as an asset of collective interest, intended to promote social justice and sustainable development. As Rizzato (2024) highlights, land grabbing represents a fraud that directly opposes the social function, as it seeks to legitimize irregular possession through document forgery or simulation of legal transactions. The evolution of this practice into the digital sphere, through the manipulation of registries like the CAR (Rural Environmental Registry), has only made the same historical logic of exclusion and land concentration more sophisticated.

From the perspective of Agrarian Law, which is an autonomous branch of law that seeks to regulate the relationship between humans and land, focusing on social justice, food production, and environmental preservation, its fundamental principles are essential for understanding and combating irregular land appropriation. Thus, the Principle of the Social Function of Property is the pillar of Agrarian Law, subordinating the individual right of property to collective interests, requiring land to be productive, respect the environment and labor relations, and promote social well-being. From this perspective, irregular land appropriation directly violates this principle, as illegitimate possession prevents the fulfillment of the property's social requirements. Since land grabbing distorts the purpose of property, turning it into an instrument of speculation and illicit accumulation, to the detriment of its social and environmental role. Therefore, land, instead of fulfilling its function of generating food and promoting development, becomes an asset for illegal exploitation, with serious consequences for society and the environment. The realization of this principle requires the expropriation of unproductive lands and their allocation for agrarian reform purposes, ensuring access to land for those who produce it and contributing to the reduction of social inequalities in the countryside.

The Principle of Social Justice seeks the equitable distribution of land and the guarantee of dignified living and working conditions in the countryside. Land grabbing, by concentrating land in the hands of a few through illicit means, aggravates social inequality and prevents the realization of social justice in rural areas. Since the practice of land grabbing contributes to social exclusion, rural exodus, and the precariousness of living conditions for traditional communities and small farmers, who are expelled from their lands or prevented from accessing them. Therefore, agrarian reform is a fundamental instrument to promote social justice in the countryside and combat land concentration, guaranteeing access to land for all who need it, and the creation of public policies that encourage family farming and the production of healthy food also contributes to social justice in the countryside.

The agrarian principle of Environmental Preservation recognizes the importance of conserving natural resources and sustainability. Thus, land grabbing, especially in agricultural frontier areas like the Amazon, is often associated with illegal deforestation and environmental degradation, contradicting this principle. In 2023, about 20% of the Amazon was devastated, including protected areas and indigenous lands, evidencing the gravity of the problem. In this situation, the destruction of ecosystems, loss of biodiversity, and emission of greenhouse gases are direct consequences of land grabbing and illegal land exploitation, with global impacts on climate and quality of life. Therefore, environmental protection is everyone's duty, and land grabbing represents a serious violation of this duty, requiring rigorous action by inspection agencies and raising societal awareness about the importance of environmental conservation. Thus, digital land grabbing compromises the fundamental rights linked to an ecologically balanced environment (Article 225 of the Federal Constitution), as the advance of land grabbing over public lands and preservation areas results in illegal deforestation and environmental degradation, making land fraud also an issue of agrarian environmental law. In this sense, the social function of land must be interpreted together with the environmental function, to ensure the sustainability of the territory and the protection of present and future generations.

The Brazilian Civil Code establishes the foundations of private law, including rules regarding property, possession, and real rights. Its provisions are crucial for the analysis of digital land grabbing, as they define what is legally recognized as property and possession, and the consequences of their acquisition by illicit means. From this analysis, Article 1,228 defines property as the right to use, enjoy, dispose of, and recover the asset, but this right is not absolute and must be exercised in accordance with its economic and social purposes. Thus, possession (Articles 1,196 et seq.) is the *de facto* exercise of the powers inherent to ownership, and digital land grabbing, by resorting to fraud in registries, constitutes an unjust and bad-faith possession. In view of this, real

rights (Article 1,225) and the acquisition of immovable property, which occurs with the registration of the transfer deed at the Real Estate Registry Office (Article 1,245), are directly affected by digital land grabbing, which seeks to circumvent this system. Moreover, the practice of digital land grabbing, involving fraud and causing damages, may generate civil liability for those involved, under the terms of Articles 186 and 927 of the Civil Code.

Regarding the Brazilian Penal Code, there is the classification of various crimes that can be applied in combating land grabbing and its ramifications. Thus, land grabbing, in its essence, is a criminal activity manifested through a series of illicit conducts, many of them foreseen in the Penal Code, and its practice involves a complex network of actors and actions, from document forgery to violence against legitimate occupants. From this perspective, one of the most common crimes in traditional and digital land grabbing is Falsification of Public Documents (Art. 297, CP), given the need to create an appearance of legality for illegitimate possession. Since certificates, property registrations (*matrículas*), notarial records, and other public documents are frequent targets of forgery, making fraud identification a challenge for authorities and requiring the modernization of registration systems, with the implementation of technologies that ensure the authenticity and inviolability of documents.

Moreover, land grabbing can also be classified as the crime of Falsification of Private Documents (Art. 298, CP), as the falsification of purchase and sale contracts, powers of attorney, and other private instruments can be forged to simulate legitimate transactions, deceiving third parties in good faith and making it difficult to prove illegality, which requires meticulous analysis of documents and verification of signature authenticity, often with the aid of forensic handwriting analysis. Finally, another classification is Ideological Falsehood (Art. 299, CP), because omitting, in a public or private document, a statement that should be included, or inserting or causing to be inserted a false or different statement from what should be written, with the aim of prejudicing a right, creating an obligation, or altering the truth about a legally relevant fact. This is often used in digital land grabbing, where data in electronic systems, such as the CAR, is manipulated to create a false registry reality, altering information about ownership, boundaries, or property characteristics. The difficulty in tracing the origin of this false information makes investigation and punishment even more complex, requiring collaboration between inspection agencies and the use of data analysis tools.

From the perspective of Administrative Law, the State's action is fundamental to guarantee the correct allocation of lands and combat improper appropriation, which often occurs in areas of great environmental or strategic value, such as forests and water sources, compromising public assets and the environment. In this way, the grabbing of public lands (*terras devolutas*) is a serious problem,

as it involves the appropriation of public goods. The application of Law No. 6,383/76 to regulate the discriminatory process of lands is fundamental. The lack of inspection and the slowness in the processes of land discrimination and appropriation (*arrecadação*) of these lands contribute to the proliferation of land grabbing, especially in remote and hard-to-access regions, such as the Amazon, where inspection is more precarious and the action of land grabbers is facilitated by the absence of the State. Expediting land regularization processes and allocating these lands for agrarian reform settlements or conservation units are essential measures to combat the grabbing of public lands, ensuring the protection of public assets and the sustainable use of natural resources.

Therefore, the set of legal, urbanistic, environmental, and social measures aimed at regularizing irregular settlements and titling their occupants. Law No. 13,465/2017 (Urban Land Regularization Law - Reurb) and other related norms seek to simplify and expedite these processes, but they also need to be robust enough to avoid being used to legitimize land grabbing. The slowness of regularization processes and the State's difficulty in inspecting and curbing such conducts contribute to the perpetuation of irregular appropriation.

From a practical standpoint, there is a normative and institutional deficit in confronting digital land grabbing. Although there are legal repression mechanisms, such as the penal offenses of falsification of public documents (Article 297 of the Penal Code) and ideological falsehood (Article 299 of the Penal Code), such provisions are insufficient in the face of the complexity of electronic fraud. The same occurs in civil actions of adverse possession, possessory actions, or discriminatory actions, which, although adequate in traditional cases of land grabbing, prove to be slow and ineffective against the speed of digital manipulations.

Another critical point lies in the absence of specific regulation for digital registries and blockchain applied to land administration, since the Brazilian legal system has not yet integrated these technologies into the registry system normatively, leaving space for criminals to use blockchain's own immutability as a "parallel notary" to give an appearance of legality to fraud.

Thus, the legal analysis demonstrates that combating digital land grabbing requires more than the application of existing norms. Legislative modernization is necessary, capable of foreseeing the validity of electronic registries, establishing rules for interoperability between digital registries and traditional registry offices, and defining technical and legal responsibilities for electronic land transactions. Furthermore, the use of artificial intelligence in cross-referencing databases can be a relevant tool for fraud prevention and transparency promotion.

5 FINAL CONSIDERATIONS

Considering all that has been presented, it is understood that the social function of rural property, a fundamental principle of the Brazilian legal system, has been constantly challenged by new realities and technologies. Digital land grabbing emerges as one of the most imminent obstacles to its effective realization, using digital tools to fraudulently register and illegally appropriate vast land areas, with serious environmental, social, and economic consequences. However, the same technology that underpins these new forms of illegality, blockchain, presents itself as a promising solution to strengthen legal security and transparency in rural land regularization.

Thus, digital land grabbing has revealed how land grabbers exploit the vulnerabilities of current systems to illegally appropriate lands, which will consequently have profound legal and social impacts. In this context, the analysis of Brazilian legislation has shown that, although there are legal tools to combat land grabbing and promote land regularization, they are insufficient to deal with the sophistication of digital land grabbing and to fully integrate blockchain innovations. Judicial slowness, lack of training, and the absence of specific regulation for blockchain registries are gaps that need to be filled.

Therefore, legislative and regulatory modernization is imperative, with the creation of specific laws that recognize the validity of blockchain registries, regulate registry office operations, define responsibilities, and ensure data protection. In the technical and operational sphere, the development of a national land registration platform on blockchain, with the standardization of geospatial data, are essential measures. Finally, social aspects, such as social participation, education, combating the digital divide, and strengthening effective public land policies, are crucial to ensuring that technology serves as a tool for social justice and sustainable development.

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Editors:

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