

GREEN BONDS AND THE GOALS OF SUSTAINABLE DEVELOPMENT: A VIABLE MEANS TO FOMENTATION OF SUSTAINABLE FAMILY AGRICULTURE IN BRAZIL

O TÍTULO VERDE E OS OBJETIVOS DO DESENVOLVIMENTO SUSTENTÁVEL: UM MEIO VIÁVEL PARA O FOMENTO À AGRICULTURA FAMILIAR SUSTENTÁVEL NO BRASIL¹

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Abstract

This article discusses the possibility of using green bonds as a way to promote sustainable family agriculture, to achieve the Sustainable Development Goals (SDGs), to which Brazil has made a commitment since the signing of the 2016 Paris Agreement. This study aims to analyze the viability of using green bonds as a way to promote sustainable family agriculture, seeking to achieve the objectives of sustainable agriculture proposed by SDG number 2 of the 2030 Agenda. The specific objectives are to present a concept of sustainable agriculture, specify the procedure of

Resumo

Este artigo aborda a possibilidade da utilização dos títulos verdes como um meio viável para o fomento da agricultura familiar sustentável, de maneira a instrumentalizar o alcance dos Objetivos do Desenvolvimento Sustentável (ODS), com os quais o Brasil é comprometido a partir da assinatura do Acordo de Paris de 2016. O trabalho teve como objetivo geral analisar a viabilidade da utilização de títulos verdes para fomentar a agricultura familiar Sustentável, visando à aproximação da conquista dos objetivos da agricultura sustentável proposta pelo ODS 02 da agenda 2030, tomando como objetivos

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green bond emissions, and demonstrate the viability of using these green bonds by the rural family producer as a way of promoting its production with sustainable techniques. As for the methodology applied, an inductive approach was used in the investigative phase, and the Cartesian method was employed in the data treatment phase. The research confirmed the initial hypothesis that, indeed, the use of green bonds to promote sustainable family agriculture and instrumentalize the Sustainable Development Goals is viable.

Keywords: Green Bonds; Social and Environmental Justice; Sustainability; Sustainable Development.

específicos a conceituação de agricultura familiar, a especificação dos procedimentos de emissão de títulos verdes e demonstrar a viabilidade de utilização destes pelo produtor rural familiar para o fomento de sua produção utilizando técnicas sustentáveis. Quanto à metodologia empregada, na fase de investigação utilizou-se o método indutivo, e na fase de tratamento de dados, o método cartesiano, sendo que a pesquisa teve como resultado a confirmação da hipótese de que, sim, é viável a utilização da titulação verde como instrumento para o fomento da agricultura familiar Sustentável e a instrumentalização dos Objetivos do Desenvolvimento Sustentável.

Palavras-chave: desenvolvimento sustentável; justiça socioambiental; sustentabilidade; Título Verde.

Introduction

Discussions surrounding the imperative to advance a more sustainable world have gained momentum over the past three decades. This has led to paramount shifts in how governments perceive society, as well as how the market functions, responding to pressing concerns about climate change and sustainability within an economic and social context.

In response to the escalating global apprehension on expanding sustainability, the United Nations (UN) devised the Sustainable Development Goals (SDGs), deliberated upon during the 2016 Paris Agreement, where 193 countries pledged to develop sustainable initiatives across 17 areas, ultimately working towards the realization of a new world characterized by enhanced environmental, social, and economic balance. This collective endeavor is widely known as the 2030 Agenda.

Sustainable Agriculture and Zero Hunger are of particular emphasis within this emerging global governance framework, as articulated in SDG 02. These initiatives hold significant relevance for Brazil, given its position as one of the world's foremost agricultural exporters. Still, the country grapples with environmental and social challenges stemming from non-sustainable farming practices and a historical preference for large-scale monocultures over sustainable family farming.

Regarding the promotion of sustainable family farming, we raise the viability

of employing green bonds, such as Integrated Crop-Livestock-Forest (ICLF) systems and other methods that reduce the reliance on agricultural pesticides while fostering low-carbon agriculture, allow for an entry into the carbon offset market.

Requiring a three-phase process for issuance, green bonds are a financial instrument exclusively tailored for sustainable investments, carrying the potential to implement the polluter-pays principle within its commercial distribution chain whenever feasible, allowing for the compensation of adverse environmental impacts through the acquisition of bonds that yield equal or greater benefits.

Therefore, there is the unavoidable need to conduct a thorough examination of each of these phases (pre-issuance, issuance, and post-issuance) to scrutinize the specific challenges and obstacles faced by family farmers, who have traditionally possessed limited technical expertise in these processes, particularly in post-issuance—which pertains to the provision of environmental reports as substantiation of their environmentally-friendly practices.

In conclusion, this study underscores the viability of leveraging such bonds and the significance of advancing sustainable agriculture from social, economic, and environmental perspectives. This aligns with the attainment of the SDGs delineated in the 2030 Agenda, a commitment Brazil has made to contribute to a more sustainable future.

1 The 2030 Agenda and sustainable agricultural development goals

1.1 The 2030 Agenda and its current status

The 2030 Agenda embodies an international commitment to human rights, developed by the United Nations (UN) and adopted by 193 countries in 2016. It outlines sustainable development goals under the expectation that the signatory countries subsequently align their governance systems with the United Nations Development Programme (UNDP), setting the year 2030 as the target deadline for achieving the established goals in the global sustainable development agenda (BRASIL, 2021).

These goals are designed to offer alternatives to the prevailing non-rationalized production model, promoting social justice and aligning these interests with the political inclinations of each country. This involves establishing cross-cutting and interdisciplinary relationships to cooperatively achieve shared development (ZEIFERT; CENCI; MANCHINI, 2020).

Therefore, the SDGs are perceived as the central pillar of the 2030 Agenda, guiding actions across the three sustainability dimensions—economic, social, and

environmental—by specifying measures to be taken to achieve these objectives (SILVA, 2018).

Those dimensions have led to the creation of 17 major goals aligned with the global agenda, further split into 169 more specific targets to be achieved by member countries by the beginning of the third decade of the millennium.

For illustrative purposes and with a focus on the Brazilian context, we highlight the Eradication of Poverty (SDG 01), Quality Education (SDG 04), and Promotion of Sustainable Consumption and Production (SDG 12) among the major goals outlined in the 2030 Agenda (BRASIL, 2021).

In a series of documents addressing this subject, the UN encourages signatory countries to develop government actions to achieve these goals while prudently considering national priorities and peculiarities in defining implementation strategies to maintain each country's sovereignty in governance, it also emphasizes that this process of prioritization should not cast a shadow upon the significance of the global agenda (SILVA, 2018).

In this scenario, there is a global effort towards sustainable development embraced by countries that, considering their local peculiarities, act in a non-uniform manner across the 17 areas of activity proposed by the SDGs, which establish specialized government committees for each of these activities.

The National Commission for Sustainable Development Goals was established to promote and align the national scenario with sustainable development goals. Through this commission, the Federal Government incorporated a joint action plan with the Institute for Applied Economic Research (*Instituto de Pesquisa Econômica Aplicada* – IPEA) intending to set tangible goals for Brazil in the coming years and effectively implement them through well-founded development initiatives (SILVA, 2018).

1.2 SDG 02: Sustainable Agriculture and Zero Hunger in Brazil

The evolution of agribusiness in Brazil is intricately interwoven with the nation's historical economic development, tracing its roots from a 16th-century sugar-driven agricultural program reliant on slave labor to the prevailing agro-industrial model (FURTADO, 2007).

Throughout history, Brazil has showcased its continentally extensive territories dedicated to agricultural, livestock, and agro-industrial progress. Typically, this system adopts large-scale monoculture as its production method, with sugar, coffee, cotton, soy, and cattle farming as primary production and export activities.

However, when practiced in an exploitative manner, this approach can lead to land depletion (ZIMMERMANN, 2011).

The adverse environmental impacts of non-rationalized agricultural development are undeniable, contributing to climate change, reduced biodiversity, and increased food insecurity for the population. This contradicts the global goals for sustainable agriculture outlined in SDG 02 (ZIMMERMANN, 2011).

Thus, there are compelling arguments against the viability of employing non-rationalized large-scale agricultural production to achieve sustainable agriculture with the objective of zero hunger, owing to significant concerns that warrant special attention.

First and foremost, it is crucial to recognize the harm caused by non-rationalized agriculture, particularly in monoculture practices, which demand intensive fertilizer and pesticide usage. This ultimately results in soil restructuring and conditioning to accommodate the mass production of a single crop, disrupting the environmental balance conducive to proper land management (ZIMMERMANN, 2011).

Similarly, it is evident that not only large-scale farmers engage in monoculture but also small-scale family farmers, with hopes of increasing their profits through large-scale production of a single product while bluntly overlooking the fact that soil conditioning will deplete the land and reduce production yields in the medium and long term (ROSA NETO; SILVA; ARAÚJO, 2020).

Hence, SDG 02, as outlined in the 2030 Agenda, holds significant relevance in a country that ranks among the world's leading agricultural product exporters, with approximately BRL 10.1 billion in exports as of August 2021 (BRASIL, 2021).

Thus, the issue of soil degradation is of paramount importance, it may lead to low-quality products being available to consumers at lower prices due to the lack of quality and potentially high pesticide content. Consequently, disadvantaged populations may consume products that, while alleviating hunger, lack the essential vitamins and minerals required for healthy development (ZIMMERMANN, 2011).

Given both economic and nutritional aspects, the significance of Brazilian agricultural, livestock, and agro-industrial products on the international stage becomes evident; therefore, prioritizing the sustainable development of national agribusiness is essential to achieving the SDGs outlined in the global agenda. This presents one of the specific needs that Brazil makes in choosing the distribution of investments towards SDG 02, as is the case with the application of the Low

Carbon Agriculture Plan (*Plano Agricultura de Baixo Carbono – ABC*) (TELLES *et al.*, 2021).

Nevertheless, it is well-known that family farmers often encounter challenges in pursuing sustainable development in their agricultural activities which include the high cost of agricultural machinery, limited workforce training, and competition in the market with large-scale producers who can frequently offer raw products at significantly lower prices due to their extensive use of agricultural pesticides and unsustainable techniques.

1.3 Sustainable family farming in Brazil

Significant structural differences emerge initially when comparing family farming to large-scale agriculture, as large-scale farms rely on rural properties of considerable proportions that often operate as commercial enterprises, while family-owned rural properties are characterized by the *Estatuto da Terra* (Statute of the Land; Law No. 4,504/1964) as follows:

Art. 4, P. II — “Family Property”, a rural property directly and personally operated by the farmer and their family, absorbing the entirety of their labor, ensuring their subsistence and socioeconomic progress, with a maximum area established for each region and type of production, while occasionally employing third-party labor assistance; [...] (BRASIL, 1964; our translation).

This legal definition holds particular relevance to the objectives of this study, as it encompasses two of the three pillars sought for the achievement of sustainable agriculture: the economic and social dimensions, with the need to also address the environmental dimension.

Economically, the importance of family-owned properties is undeniable. Recent statistics indicate that family farming represents 20% of all agricultural and livestock development in Brazil. It even claims over 60% of the national production of essential products such as açai (78.7%), bell peppers (70.8%), cassava (69.6%), and cow’s milk (64.2%), which constitute a significant portion of the national diet² (ROSA NETO; SILVA; ARAÚJO, 2020).

For the family farmer considered in this study, the economic pillar closely intertwines with the social, as property management is typically handled exclusively by the family itself in an approach that absorbs their labor force while providing them with sustenance and socioeconomic progress, showcasing the effectiveness of the law.

² The statistics are based on the most recent data obtained from the IBGE Census conducted between 2017-2018.

Also, family-owned properties play a crucial role in the land democratization process, aligning with the social function of property by enabling access to rural land for a larger number of people through family management. This strengthens the foundation of the social pillar which is essential for sustainable development (MARQUES; MARQUES, 2017).

It is, thus, imperative to find means to promote the environmental pillar within the context of family farming, providing rural producers with immediate economic incentives for sustainability considering the pressing need to consider that, while sustainable management leads to long-term productivity gains, there may be short- and medium-term reductions compared to unsustainable practices. Therefore, creating incentives for family farmers to plan production in a manner that adheres to environmental well-being limits is crucial to achieving the sustainable agriculture envisioned in SDG 02 without compromising their family's subsistence.

2 Green bonds and the enforcement of the polluter pays principle

2.1 Sustainable finance

The signing of international cooperation treaties centered on sustainable environmental practices has marked a pivotal shift in the global economy. The Kyoto Protocol in 1997, addressing climate change and the regulation of greenhouse gas emissions into the atmosphere, along with the 2016 Paris Agreement, stand as two significant economic milestones that illustrate the transformation in market perspectives by compelling major economic players to acknowledge the urgency of global climate change risks (CURI, 2021).

Climate-related concerns are now an integral part of investment decisions in the international market, incorporating considerations of social, environmental, and governance factors into the decision-making process. On one hand, companies prefer to invest in projects transitioning towards a low-carbon economy and in the pursuit of environmental impact mitigation. Economic actors themselves promote such business choices, defined as sustainable finance (CURI, 2021).

In this context, green finance refers to funding for green investments, encompassing both public and private initiatives. The term “green” is used as a metonymy for “sustainability”, encompassing not only areas related to environmental goods and services, such as biodiversity protection but also compensation for environmental and climate damage. It also includes funding for public policies that promote the advancement of these initiatives (MAROSTICA, 2019).

As a result, there is a sector dedicated to sustainable investments within the financial system, including entities like the Green Climate Fund and financial instruments for green investment, which also encompass *green bonds*.

2.2 Green bonds and the polluter pays principle

Green bonds, known for their focus on sustainability and socio-environmental projects, are a modality of debt security. They offer investors not only financial returns in the form of dividends but also a connection to the preservation, restoration, and protection of the natural environment (CAPRIOTTI; SCHMID, 2017).

The concept of green bonds was initiated in 2008 to incentivize activities benefiting the environment, particularly those aimed at combating climate change, influenced by the Kyoto Protocol. Over the past decade, it has gained momentum following the 2016 Paris Agreement, which expanded its goal to combat the climate implications of greenhouse gas emissions. Ratified by 195 countries, the agreement is a commitment to investing in climate change mitigation and adaptation through less polluting systems (BRAZIL, 2016).

Achieving a low-carbon economy undoubtedly requires substantial investments. However, studies suggest that this can be achieved by around 2030 (MAROSTICA, 2019), considering that public investments support this notion, exemplified by programs like Brazil's National Soil Program (*Programa Nacional de Solos do Brasil* – PronaSolos). Coordinated with the involvement of various ministries and organizations, the program aims to survey, characterize, and improve Brazilian soil to enable more sustainable agricultural systems through technological advancements (CAMARGO; SOARES, 2021).

With its diverse and valuable environmental assets, Brazil stands as one of the countries with significant potential for issuing green bonds and thereby raising funds for sustainable development. The market has witnessed a substantial increase in the issuance of green bonds, potentially reaching USD 950 billion, with an average annual growth rate of 7% (CARDIAL, 2023).

Unlike standard debt securities, the green bond system involves a three-phase issuance process. In the pre-issuance phase, an analysis of the financial, political, and economic conditions in the area undergoing certification is conducted. Special attention is paid to the environmental, social, and governance aspects of the region to enable issuance by accredited financial institutions. During this phase, the bond will be financially instrumentalized (CAPRIOTTI; SCHMID, 2017).

The issuance phase, resembling conventional debt securities, entails determining offering methods, terms, currency, and applicable guarantees to make the issuance appealing and viable in the market. Additionally, whenever possible, the bond should specify the green aspect highlighted in the project to enhance its credibility (FEBRABAN; CEBDS, 2016).

In this stage, known as the issuance phase, the green bond operates much like a traditional debt instrument. Various strategies for offering the bond as a financial instrument are employed, including setting terms, currency, and applicable guarantees to make it viable and appealing to the market. Whenever possible, the bond should specify the specific environmental aspect it aims to highlight in its development, to enhance its credibility (FEBRABAN; CEBDS, 2016).

Unlike standard bonds, green bonds undergo a third phase called post-issuance, where environmental performance indicators obtained through the certification process must be reported to investors at least annually. This reporting is crucial to ensure transparency and credibility for the investment, particularly when considering the achievement of Sustainable Development Goals (FEBRABAN; CEBDS, 2016).

At this point, it is essential to consider the implementation of the “polluter pays” principle, as outlined in Article 4, VII, of Law No. 6,938/81, the Brazilian National Environmental Policy Law (BRASIL, 1981)³.

This principle asserts that polluters must be held responsible for the harm they inflict on the environment, and this responsibility is converted into the form of payment, which can be either delivered as financial contributions or environmental remediation actions. Therefore, the principle emphasizes that those who benefit from natural resources must bear their associated costs and consequences (COLOMBO, 2004).

It is crucial to clarify that this principle does not condone pollution or the idea of “affording to pollute”. Rather, it aims to ensure economic compensation for environmental damage when preventive measures are not feasible. Therefore, this principle encompasses costs for both precautionary and preventive measures to avoid harm, beyond mere environmental compensation (COLOMBO, 2004).

In the case of green bonds, there is an application of this relationship within the private sector, combining the previously explained principle of the polluter pays with its counterpart (hence, calling for no further elaboration), the principle of the protector-receiver.

³ VII – Imposing, on polluters and predators, the obligation to restore and/or compensate for the damages caused, and on users, the contribution for the use of environmental resources for economic purposes.

Consider a scenario where an individual, such as a collector of recyclable materials, gathers and recycles tons of plastic in their city. In this context, this person can undoubtedly be considered a protector, engaging in sustainable activities that make them eligible to issue green bonds to finance their sustainable business endeavors.

Among the interested investors, there will likely be entities that have a history of causing environmental harm and, therefore, must account for their past actions. By acquiring these bonds and reviewing the environmental performance indicators provided during the post-issuance phase, these entities become beneficiaries of a nature-related benefit that serves as compensation for environmental benefits either equivalent to or greater than the harm caused by the exploitative activities, they may have previously undertaken.

In this scenario, green bonds are used as a means of financial compensation for the well-being and preservation that a particular sustainable activity promotes in nature. This benefit is assessed during the pre-issuance phase, quantified in the post-issuance phase through mandatory reports, and offered in the market to companies that generate negative externalities for the environment.

2.3 The carbon credit market, green bonds, and their applicability in the sustainable agriculture system

In the context of sustainability, carbon emissions, and other greenhouse gases are recognized as significantly harmful. These emissions are generated by various sources, including industries, combustion-engine vehicles, and livestock. However, it is possible (and in many cases, advisable) to offset these emissions through green bonds by employing techniques that neutralize carbon emissions within specific regions.

One such sustainable production strategy is the Integrated Crop-Livestock-Forest System (ICLFS), which combines agricultural and forestry activities in the same area through mixed cropping. This approach aims to achieve environmental compliance and economic viability, ultimately enhancing soil fertility and conservation, cost-effective pasture recovery, improvements in soil physical, chemical, and biological properties, and increased labor and equipment efficiency (BALBINO; CORDEIRO; MARTÍNEZ, 2011).

Furthermore, the ICLFS promotes low-carbon agriculture, a concept encouraged by the Federal Government through the ABC plan. This approach, along with more efficient and cost-effective agricultural production, allows

for a net reduction in greenhouse gas emissions. In other words, it enables the conversion of more pollutants into oxygen than the emissions produced (TELLES *et al.*, 2021).

On average, it is estimated that a mature tree can neutralize the carbon emissions equivalent to those produced by up to 13 mature cattle. In this context, neutralization refers to returning to nature the exact amount of oxygen (measured in kg/time) equivalent to the pollution generated by carbon emissions. In other words, a mature tree can convert the gases emitted by 13 mature cattle into oxygen (BALBINO; CORDEIRO; MARTÍNEZ, 2011).

It's essential to recognize that carbon is not the only element eligible for offsetting through the exchange of nature-related benefits. Other gases, such as methane, are also subject to compensation. However, carbon is the primary focus of discussions in this area and deserves special attention.

An entire system is established for trading green bonds to facilitate the circulation of carbon credits through tradable emission reduction units based on the principle of certified emission reductions that generate carbon credits, which can be traded in the international market (MAROSTICA, 2019).

The primary objective of carbon credit trading is to incentivize the development of carbon sequestration systems, particularly in developing countries, using financial contributions from developed nations.

This approach enhances economic efficiency and serves as a catalyst for achieving greenhouse gas reduction targets outlined in international protocols. However, it is crucial to emphasize that the reduced emissions primarily consist of those contributing to the greenhouse effect and do not reward clean activities previously established (MAROSTICA, 2019).

As companies continue to emit polluting gases, the pursuit of a net-zero emissions market becomes increasingly attractive. This allows corporations to obtain the necessary green bonds for trading with countries and economic groups committed to sustainability.

3 Green bonds as a catalyst for family farming and sustainable development

When analyzing the intentions surrounding green bonds in a globalized context, contrasting them with the goals established through the Paris Agreement that constitute the SDGs, there is potential to establish a connection between the two. This connection aligns the first group with international sustainability projects, highlighting a point of mutual interest: the green world.

In this regard, any sustainable activities are eligible for financing through green bonds. However, a specific question arises: Is it viable for small-scale farmers, particularly family farmers, to utilize green bonds? What are the advantages, and can green bonds genuinely support sustainable small or medium-scale family farming, leading to socioeconomic improvements for these families and environmental benefits?

The concept of sustainable development gains more significance when analyzing the social environment in which the SDGs are embedded, particularly concerning issues related to sustainable family farming.

Between 2016 and 2020, the Brazilian Federal Government successfully implemented the ABC Plan, which aimed to restore 15 million hectares of degraded pastures and promote the adoption of ICLFS on 4 million hectares of land. This not only demonstrates the government's interest in encouraging these practices but also highlights the effectiveness of the proposed measures (TELLES *et al.*, 2021).

As previously mentioned, several socioeconomic factors directly affect family farming, calling for well-planned land management, the use of specialized machinery, family labor contributions, and the implementation of intelligent farming practices to achieve sustainability.

3.1 Feasibility in the pre-issuance and issuance phases of green bonds for sustainable family farmers

As previously mentioned, the process of issuing and maintaining green bonds follows a three-phase approach. In the initial phase, which assesses the feasibility of issuing the bond in the international market, it's essential to analyze not only environmental aspects but also regional governance and social considerations (CAPRIOTTI; SCHMID, 2017).

The issue of environmental and governance aspects becomes more relevant for the analysis at the time of post-issuance, which is why, at the first moment, the other issues involved in the issuance of the bond will be discussed.

Brazilian Land Law (Law No. 4,504/1964) emphasizes the importance of family-owned properties in the social context, highlighting that these properties are developed through the collective efforts of the family group, utilizing their full labor force (BRASIL, 1964). Consequently, the income generated from these properties typically supports the family, either through the sale of raw agricultural products, such as grains and livestock, or through hand-made products like cheese and processed meats.

The constitutional concept of the social function of rural property underscores ideas related to land reform. However, the most relevant aspect of this study is understanding the role that rural properties play in society by fulfilling social, economic, labor, and environmental obligations that satisfy the material needs of their owners and contribute to the well-being of the community (MARQUES; MARQUES, 2017).

From an economic perspective, the opportunities for green bonds include extractive activities, forestry, and sustainable agriculture, which generated over 11 billion dollars in revenue in the first five months of 2022 (BRASIL, 2022a) alone. This points to significant potential for enhancing sustainable agricultural practices for family farmers.

Providing insights into the financial and sustainable viability of green bonds in the pre-issuance phase, allowing for their submission to registered financial institutions for issuance and availability in the market, as described in the second section of this study.

3.2 The feasibility of green bonds maintenance by family farmers in the post-issuance phase

The post-issuance phase is focused on ensuring the sustainable use of green investments, as the key differentiator of green bonds lies in the reputation and trustworthiness of the issuer. It represents the duty to provide credibility and maturity to the market (FEBRABAN; CEBDS, 2016).

In this regard, viability involves the ability and suitable tools for rural producers to provide the necessary information required by green bonds, especially concerning the environmental performance indicators of green projects. These indicators must be measured according to specific parameters for each type of activity (FEBRABAN; CEBDS, 2016).

The Federal Government facilitates this process through periodic information requirements, such as the Rural Environmental Registry (*Cadastro Ambiental Rural* – CAR), established by Law No. 12,651/2012 as an online and integrated platform for rural landowners to provide information about their lands, which must be updated annually.

Through CAR, all information regarding the environmental status of Permanent Preservation Areas (PPAs), Legal Reserves, Forests, Remnants of Native Vegetation, Restricted Use Areas, and Consolidated Areas of rural properties in the country is compiled into an integrated database, complete with satellite images, available to the entire population (LAUDARES, SILVA; BORGES, 2014, p. 117; our translation).

Therefore, CAR requires owners of all rural properties to provide environmental information about their land, ranging from PPAs to the correct measurement of riparian forest areas generated automatically by the government's georeferencing system. This information is made available to the entire population for consultation, making it attractive to investors (LAUDARES; SILVA; BORGES, 2014).

Besides this system, rural producers are legally required to provide information to the Federal Technical Registry (*Cadastro Técnico Federal* – CTF; Ibama), established by the National Environmental Policy Law, as agricultural activities involve the extraction or management of environmental resources.

Based on the information provided to the government, which is considered a statutory obligation that rural producers must fulfill due to the exploitative nature of their commercial activity in the natural environment, this information can—and should—be used by green bond issuers to assist in providing accountability to investors. This helps verify compliance with the green requirements for bond issuance.

However, while these obligations can be used by family farmers to prove their green status, bond issuers often employ external assessment agents to provide notes to increase the reliability of the issued bonds. This brings greater security to small family farmers who may lack the technical expertise and means to provide detailed information about their property (FEBRABAN; CEBDS, 2016).

The green bonds system, which includes the carbon credit compensation mentioned in section 2.3 of this study, presents a similar level of complexity. In this case, the presentation of results in terms of tons of carbon converted into oxygen within the property is required. This is achieved through sustainable practices during the reporting period, allowing for the quantification of carbon credits issued during that period, which can be sold to offset emissions by polluting companies (FEBRABAN; CEBDS, 2016).

From this analysis, it becomes evident that the bureaucratic issues surrounding the issuance of green bonds do not pose a significant obstacle for small farmers to obtain green investments to improve their family production. However, there is one question left to be examined to solidify the feasibility of using this instrument to promote sustainable family farming in Brazil: the costs and remuneration of bond issuance.

It should be noted that, unlike common operations in the international market, where bonds are typically negotiated with pre-set remuneration, many bonds issued and traded in Brazil offer fixed income with a post-fixed interest

rate. This is primarily due to Brazil's historical inflation, which provides greater financial security within the bond itself (KNOCH; PLASKEN, 2020).

Given the potential to enhance the profitability and reliability of national green bonds, these bonds are issued with various options, such as an annual interest rate of 105% of the CDI⁴ or those tied to inflation correction indices and supplemented with a predetermined rate, for example, IPCA + 5% per year (KNOCH; PLASKEN, 2020).

These fixed-income green bonds are then made available to the investment market through major banks or independent investment brokerages, which generally do not impose brokerage or custody fees, making them financially attractive for both rural producers and green investors, providing them with a low-cost market maintenance investment opportunity and guaranteed income (KNOCH; PLASKEN, 2020).

Therefore, the economic, political, social, and environmental scenarios demonstrate the feasibility of using green bonds to promote sustainable family farming in Brazil, with prospects for exponential growth in a market that already generates annual values exceeding 6 billion reais and contributes to the achievement of the Sustainable Development Goals (SDGs), to which Brazil is committed, particularly in terms of sustainable agriculture and zero hunger.

Conclusion

The scale of the Brazilian agro-industrial sector is evident, representing not only a consolidated position in the international market but also a historical and cultural movement inherent to the nation and observable throughout Brazil's economic development, evolving alongside history and contemporary society.

The new paradigm of sustainability, introduced to the world from Stockholm in 1972 but developed more rigorously through subsequent agreements that elaborated on and individualized issues related to sustainable development—such as the Brundtland Report, the Kyoto Protocol, and the Paris Agreement—is also paradigmatic in agribusiness.

Considering, then, the role of Brazil as a global agro-industrial supplier,

⁴ “[...] the Certificate of Interbank Deposits Rate (*Certificado de Depósito Interbancário*, CDI) is the primary benchmark indicator for the yield of various types of investments, especially those that are fixed income (as presented subsequently). It is a very short-term bond (typically good for 24 hours) issued by banks to back interbank lending operations, aiming to balance their cash reserves. There is a daily rate (DI rate), calculated by B3, based on the transactions conducted during the day, as well as monthly and annual rates. CDI closely mirrors the Selic, the economy's basic interest rate defined by the Central Bank, but is slightly lower” (KNOCH; PLASKEN, 2020, p. 22; our translation).

aligning with sustainability and sustainable development criteria due to political requirements and, above all, market demand driven by consumer awareness, the Brazilian agricultural sector has taken steps to remain a vital player in this significant market.

Brazil's unique characteristics provide an opportunity for further development of specific aspects of the Paris Agreement and, for this study, particular emphasis has been placed on SDG 02: Sustainable agriculture and zero hunger.

In this context, when analyzing the viability of using green bonds to promote agribusiness, it is evident that there is a potential market where Brazil stands as a significant investment opportunity, given the quality and quantity of natural resources, in addition to a climate that allows for a broader range of crops and livestock.

In this scenario of market relevance and the pursuit of sustainability, the significant importance of family-owned rural properties in national agriculture becomes evident. A substantial portion of the country's rural production stems from family farming, contradicting the notion of productive effectiveness solely attributed to large monocultures.

Therefore, intending to encourage sustainable agriculture practices among family producers in Brazil, this study sought to develop an understanding of green bonds, which are credit instruments exclusively designed for sustainable activities, covering the entire process of structuring the bonds, from pre-issuance to post-issuance.

The text progresses to unite the two central study points of this work, as they share a common goal (the intention of sustainable progress) to analyze the feasibility of using green bonds to promote sustainable family farming and achieve the goals of the 2030 Agenda.

It becomes clear that the greatest challenge faced by family producers lies in the post-issuance phase when the presentation of reports demonstrating the achievement of sustainable goals proposed at the time of the green bonds' issuance becomes necessary.

Given that the Federal Government itself requires the provision of sustainability-related information regarding agricultural production through systems like CAR and CTF, a significant portion of the reports is already available online to investors on federal portals.

Considering that brokerage costs are low, and the necessary reports do not incur significant additional expenses due to the existing requirement for environmental information reporting to the government, it is worth noting that there

is an economic, social, and political-environmental appeal for family farming to transition towards rationalized activities through the principles of sustainable agriculture.

By employing sustainable techniques like ICLFS, not only can this result in products of higher nutritional quality—a step closer to the goal of zero hunger—but also, the promotion of these techniques in the rationalization of agricultural production through green bonds appears feasible. This would enable family farmers to play a significant role in achieving the targets outlined in the 2030 Agenda without having to forego any essential financial returns necessary for the livelihood and dignity of the farming family, which relies on the land.

For these reasons, the appreciation of agricultural culture, farming families, and especially sustainable practices through market promotion instruments becomes a vital catalyst for the attainment of international goals while ensuring the sustainability of a market that supports a significant portion of the Brazilian population.

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