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Sustainable geographical indications? Inclusion of sustainability criteria in the Denomination of Origin Campos de Cima da Serra, Brazil

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Abstract. The objective of this study is to assess the potential for integrating sustainability guidelines into Geographical Indications of wine, especially in the case of the Denomination of Origin Campos de Cima da Serra (CCS), Brazil. Sustainability is an important topic to the wine sector and several wine regions have been developing their own programs and frameworks, in terms of management and self-assessment. However, the integration of sustainability practices into geographical indications is not evident, especially when it comes to Specifications Notebook (SN). CCS is a relatively new wine region in Brazil that has emerged over the last 25 years. The DO, expected to be filed for registration in 2025, intends to be the first region in Brazil with sustainability criteria in the SN. The study was based on the BaccuS platform, and had a broad scope, including environmental, social, economic, political-institutional and territorial dimensions. The diagnosis pointed out several ongoing actions and the presence of certifications such as globalgap and food safety. Based on the diagnosis, four main themes were identified that could potentially be integrated into the SN: circular economy, biodiversity, agricultural practices, and valorization of DO and territory. The format is being evaluated for validation with producers.

1. Introduction

Geographical indications (GIs) are an intellectual property asset that recognizes products linked to a territory. In a broad concept, the term geographical indication refers to products with a defined origin, incorporating intangible assets, such as reputation, environmental and human factors, which reflect the identity and culture of a given geographic space, providing products with their own characteristics[1]. Although the main function of a GI is to recognize and protect the specificities of producing regions, its application ends up bringing repercussions in terms of preserving heritage and adding value to products. For all these reasons, GIs are often the focus of public policies or territorial development strategies.

Working on sustainability in the wine industry is a trend and will increasingly be a requirement, whether legal, for consumers or society as a whole, or to address environmental issues such as those related to climate change. Several producing regions around the world have been adopting sustainability programs (Flores, 2018). However, the integration of sustainability practices into geographical indications is not evident, especially when it comes to Specifications Notebook (SN). The objective of this study is to assess the potential for integrating sustainability guidelines into Geographical Indications of wine, especially in the case of the Denomination of Origin Campos de Cima da Serra (CCS), which is being structured for recognition.

In the case of Brazil, GIs are a recent topic, with the first positive legislation only in 1996. The first recognized region in Brazil was Vale dos Vinhedos, registered in 2002 as a geographical indication - the region was recognized as a denomination of origin in 2012. The topic has grown in representation and importance, considering quantitative and qualitative aspects, such as number, diversity, academic impact and knowledge of the general public[2]. By April 2025, Brazil had 132 demarcated regions, 103 as geographical indications and 29 as Denomination of Origin (DO), covering 25 of the 27 units of the federation[3].

Considering wine, until April 2025, there are 11 geographical indications (Vale dos Vinhedos, Pinto Bandeira, Altos Montes, Monte Belo, Farroupilha, Campanha Gaúcha, Vales da Uva Goethe, Vinhos de Altitude de Santa Catarina, Bituruna, Vale do São Francisco e Sul de Minas) and 2 designations of origin

(Vale dos Vinhedos and Altos de Pinto Bandeira). Three more designations of origin are in the study phase for registration (Campos de Cima da Serra, Sul de Minas and Farroupilha).

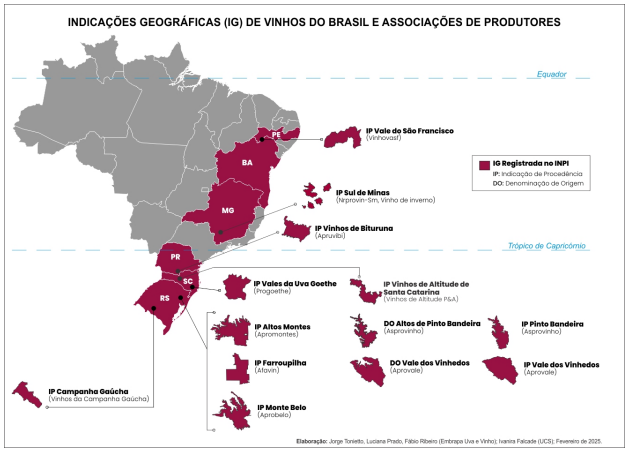

Figure 1. Wine geographical indications and designations of origin in Brazil.

Brazil is a reference country in several aspects of sustainability, including the recycling of aluminum and agrochemical packaging, in which the country is a world leader. Other points worth highlighting are: renewable energy, biofuels and protected areas. In terms of the wine industry, Brazil presents a gap, since practices are specific initiatives by producers and wineries, instead of institutional programs. In terms of wine GIs and DOs, more recently two Brazilian regions have included in their SN the willingness to work on the topic of sustainability, but have not established more precise criteria or commitments to date. CCS is a relatively new wine region in Brazil that has emerged over the last 25 years. The project to structure the DO has begun in 2022 and is expected to be filed for registration in 2025. Sustainability was chosen as one of the axes in the project' scope, aiming to be the first region in Brazil with sustainability criteria in the SN.

The article presents the results of the diagnosis carried out in the region and the first steps towards finding points of convergence for the advancement of the topic. In this way, the text aims to contribute to the systematization of the work carried out and also to the broader discussion on the integration of sustainability criteria in geographical indications and designations of origin in the wine sector.

2. Background

Sustainability in the wine industry is a trend and will increasingly be a requirement, whether legal, for consumers or society as a whole, or for tackling environmental issues such as those related to climate change; the trend is also reflected in the growth of research on the subject[4, 5, 6]. Several producing regions in the international context have been adopting programs as a way of positioning themselves on the issue in front of markets and consumers, in addition to disseminating practices[7].

Sustainability is a topic on the OIV agenda, including discussions ranging from the definition of sustainable viticulture to specific topics more focused on vineyard management, and even broader issues. Among the specific topics, Resolutions 655/2021 on microbiotic biodiversity in vineyards and 705/2022, which provides alternative recommendations for the use of herbicides, stand out[8, 9]. More broadly, Resolution 518/2016 is based on the systematized concept of viticulture and relates principles for programs, already suggesting areas and evaluation indicators[10]. In 2020, Resolution 641 provides a guide for implementing sustainability principles in winemaking, suggesting tools and listing the main challenges facing the sector for implementing the defined sustainability principles[11].

Despite the various initiatives, the alignment of sustainability with GIs is not clear, especially considering their inclusion as criteria in CETs. By definition, GIs are intellectual property assets and protection instruments. The inclusion of sustainability in GIs reflects the evolution of expectations regarding them, as GIs have expanded from the initial scope of quality linked to origin and tradition (natural and human factors) to improve sustainable food systems[12]. Although their impacts may vary according to the context, GIs have assumed the status of development tools, particularly in policies aimed at territorial development in rural areas marginalized from agricultural intensification processes[12, 13, 14]. Supporting diagnostics and structuring of GI has become a frequent public policy in many countries[15]. The literature on sustainability and GIs tends to report successful and unsuccessful experiences regarding environmental preservation, and does not discuss the need to make the admission of commitments by GIs mandatory[16] .

The inclusion of sustainability criteria in geographical indications has been discussed within the European Union. France has had guidelines in this regard since 2016 and, as of 2020, legislation provides for the adoption of environmental sustainability criteria or certifications in GIs, which can occur in three ways: (1) introduction of environmental criteria in the Technical Specifications Notebooks (CETs), (2) adopt environmental certification or equivalent for organic agriculture, or (3) include in the CET the obligation of environmental certification or organic agriculture.

The recent EU Regulation 2024/1143 also proposes the alignment of sustainability with GIs. The European Regulation states that producers of products designated by geographical indications must be encouraged to adopt sustainable practices that encompass environmental, social and economic objectives, going beyond mandatory standards. These practices can be defined in the product specification or in an autonomous initiative. Sustainability practices included in the specification should cover three main types of sustainability: environmental, social and economic. Geographical Indications are increasingly being explored as a tool to support local sustainable development and the strategies of the stakeholders involved play a key

role in directing GIs beyond the aspects of geographical name protection[17].

The European Commission's "Proposal for a Regulation on European Union geographical indications for wines, spirits and agricultural products and quality schemes for agricultural products"[18] suggests increasing the contribution of GIs to environmental preservation as one of its six main objectives. In terms of producer organization, in this regard, the opportunity to include sustainability commitments within GIs can be highlighted.

3. Methodological procedures

The study is exploratory in nature and has a qualitative approach and was structured based on Design Science Research (DSR). DSR was chosen because it is an epistemological-methodological approach that relates the development of a product with the generation of theoretical scientific knowledge. In this way, DSR supports the realization of research that focuses on the development of products that meet the demands of the actors involved, while generating new scientific knowledge, as a way of contributing to society and academia [19, 20].

The study was structured into four main components, summarized in the schema below (Figure 2). Figures were organized with the support of Napkin (version beta-0.11.0).

- Diagnosis of the Current Situation, based on the BaccuS platform (https://www.baccus.net.br/)[21], a comprehensive assessment was conducted across environmental, social, economic, political-institutional, and territorial dimensions, evaluating 19 themes, unfolded into 100 indicators, which can be condensed into 10 summary indicators[22]. Table 1 presents the dimensions and the themes.

Table 1. BaccuS framework structure.

Dimension	Themes
Environment	• water • air • effluents • waste • energy • biodiversity • agricultural practices
Economic	• production and operations • management systems • diversification
Social	• internal public, • community • territory
Political-institutional	• governance • territorial articulation,
Territorial	• knowledge • cooperation and heritage • landscape • culture valorization

- Identification of Potentialities and Convergences in order to identify ongoing sustainability initiatives. For each of the indicators, the current situation and potential for action were identified.
- Proposal of Sustainability Criteria, based on the diagnosis, key themes were identified.
- Validation of the Criteria with Producers, the proposed sustainability criteria will undergo evaluation and validation with local producers to ensure feasibility and alignment with regional practices.

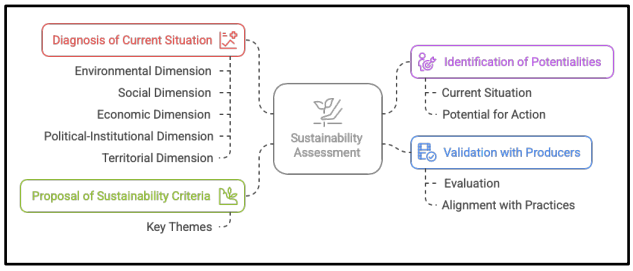

Figure 2. Methodological schema

4. Results and discussion

First, the Campos de Cima de Serra region will be briefly presented, including the main characteristics and process for the denomination of origin. Next, the sustainability diagnosis carried out in the region will be discussed and, finally, the proposal for inclusion of criteria in the DO.

4.1. Campos de Cima da Serra

The Campos de Cima da Serra region is one of the most recent centers of Brazilian winemaking, having developed over the last 25 years. The region's vineyards are located on basaltic soil, between 800 and 1,000 meters above sea level. The location influences the region's climate, prolonging the vine's vegetative cycle between budding and grape ripening. This climatic effect gives the grapes specific characteristics, which are reflected in the unique qualities of the wines produced. The region's wines have been the focus of research, including physical-chemical and sensory characterization, among other topics.

Wine production in the CCS is carried out in the following cities: Vacaria, Monte Alegre dos Campos and Muitos Capões. The vineyards are trained using a trellis system. The main red grape varieties are Merlot, Pinot Noir and Cabernet Sauvignon, while the white grape varieties are Chardonnay and Sauvignon Blanc.

The Association of Winegrowers of Campos de Cima da Serra (AVICCS) was created in 2017, with the aim of bringing together producers and structuring a geographical indication. In 2018, a diagnosis was carried out by IFRS and Embrapa Grape and Wine. The project to deepen the studies and structure the designation of origin began in 2022 and is scheduled to be filed in 2025.

4.2. Sustainability assessment

The environmental dimension of sustainability focuses on minimizing the ecological footprint, reducing the use of natural resources like water and energy, enhancing product quality with respect to environmental and cultural aspects, and contributing to the restoration of local ecosystems[22]. The diagnosis of the environmental dimension pointed to several actions, systematized in figure 3.

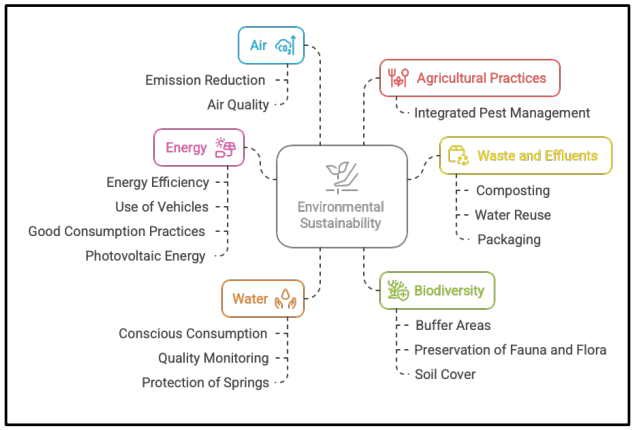

Figure 3. Main environmental sustainability initiatives in CCS wine producers

The actions in the environmental area are broad and encompass all the themes proposed in the BaccuS framework. In terms of energy, there are several actions aimed at efficiency, such as optimizing the use of light bulbs and vehicles, in addition to investing in equipment with lower energy consumption. Efficiency is also used in the facilities, considering thermal insulation. Information on good consumption practices is disseminated among the teams. The use of renewable energy stands out, whether in the use of biofuels or photovoltaic energy. In terms of air quality, equipment maintenance and periodic adjustment of sprayers are carried out.

The themes of waste and effluents were grouped in the analysis. Composting initiatives were identified with bagasse, stalks, seeds and sludge from the ETE, with forwarding to partner companies for processing. The water from the effluent treatment is reused for irrigation. Initiatives for the reuse and repurposing of materials and packaging were also identified. Agrochemical packaging is sent for recycling at a plant in the region.

In terms of water, internal actions were identified for conscious consumption, for example, returning the surplus irrigation water from the vineyard to the production cycle, and treating and reusing water from the winery's internal processes. Water quality is monitored based on physical and biological parameters.

Considering agricultural practices, numerous initiatives are also carried out in terms of integrated pest management, such as the use of insect baits or alternative techniques. Work is also being done to limit and even eliminate the use of herbicides. One of the wineries uses geese to control vegetation in the vineyard, which helps reduce the use of products and vehicle traffic, and also has a positive impact on soil health. Other examples of practices include planting along contour lines and using fertilizer from composting.

In terms of biodiversity, initiatives such as maintaining soil cover in vineyards and maintaining native vegetation around the vineyard were identified. Other actions to preserve fauna, flora and springs were also present. Buffer areas were identified, which contribute to reducing the potential impacts of agrochemical drift in/from the vineyard. In addition, the region has proactive actions to preserve native vegetation, such as identifying native trees and planting new varieties. Another action is the planting of flowerbeds, which are an alternative technique for attracting insects and also contribute to biodiversity.

The analysis considered sustainability in a broad scope, including the economic, social, political-institutional and territorial dimensions. The main findings are systematized in the following diagram (Figure 4).

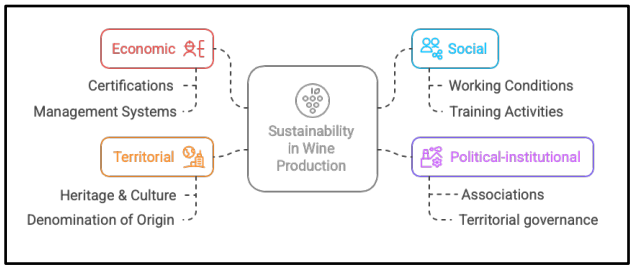

Figure 4. Main sustainability initiatives in CCS wine producers in economic, social, political-institucional and territorial dimensions

The economic dimension of sustainability considers territorial approach, refers not just to wineries performance, but also includes the territorial added value, highlighting territorial based products[22]. Considering the economic factors, the presence of certifications and management systems such as Good Agricultural Practices (GAP), Good Production Practices (GPP) and the presence of the GlobalGap certification stand out. In fact, one of the wineries uses the BaccuS platform for its management system.

In terms of social sustainability, the dimension represents at the same time the life quality and the social indicators that go through the ethical relationships with stakeholders, which includes the issue related to the participation in associations of the territory[22]. On the other hand, the political-institutional dimension focuses on the role of associations and representative bodies in relation to local issues and external contexts[22]. Considering social dimension, the initiatives in terms of improving labor conditions and training activities, can be highlighted.

Associations are considered in two dimensions due to their important role in terms of governance and territorial articulation. In this sense, the participation of local wineries in entities in the sector, such as the Brazilian Enology Association (ABE) and the Brazilian Sommeliers Association (ABS), is highlighted. In terms of territorial

governance, the Association of Winegrowers of Campos de Cima da Serra (AVICCS) is an important body of action and is leading the project for the Denomination of Origin.

The territorial sustainability dimension is related with the capacity to promote local identity reproduction and development. In terms of wines, the territorial dimension represents the link between product characteristics and territory identity[22]. Actions to enhance the region's heritage and culture were identified, such as actions to revive livestock farming and Azorean culture. Educational initiatives were also identified, whether in strengthening research on the region or in environmental education actions in local schools. In addition, the influence of territorial elements on the quality of grapes and wines, such as altitudes above 800 m, was highlighted. Studies involving the structuring of the DO are contributing to greater knowledge of the territory and the systematization of the elements that make up this wine-growing terroir.

4.3. Potential sustainability criteria for the DO

Based on the diagnosis, four main themes were identified that could potentially be integrated into the SN: circular economy, biodiversity, agricultural practices, and valorization of DO and territory.

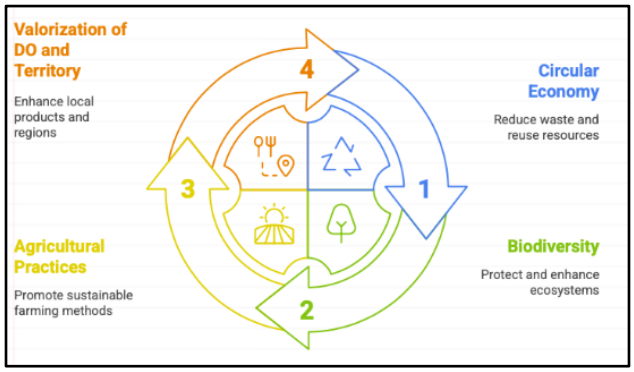

Figure 5. Potential sustainability criteria for the DO

The circular economy seeks to minimize waste and maximize the efficient use of resources by promoting the reuse, recycling, repair and regeneration of products and materials throughout their life cycle. The circular economy is related to a series of environmental issues, such as eco-efficiency, resource use and waste reduction. Initiatives such as the reuse of water from wastewater treatment for irrigation, or the use of fertilizers from composting are typical examples of the circular economy. Other examples of circularity include architectural elements such as thermal insulation, energy efficiency initiatives and the use of renewable energy itself.

Biodiversity is another broad-ranging topic in terms of sustainability, encompassing actions to preserve fauna and flora, including practices such as maintaining soil cover, buffer areas, and environmental education initiatives. The topic has an interface with the dimension of agricultural practices. In turn, agricultural practices address various initiatives in the vineyard, aligned with integrated management.

Finally, the valorization of the DO and the territory proposes a more focused look at heritage and culture, adding territorial value to the region's products. Here, actions are systematized to value the denomination of origin, in structuring.

5. Conclusions and perspectives

Sustainability is an urgent and complex issue, and the breadth of discussions often makes it difficult to take action. The issue has been discussed within wine regions and its connection with geographical indications is very timely. However, there is still a lack of examples that can be replicated or provide a path to follow.

In this study, the diagnosis pointed out several ongoing actions and the presence of certifications such as globalgap and food safety. One of the wineries even has a sustainability management system and the theme is included in the winery's mission. Several initiatives were also identified in the area of agricultural practices, such as the reduction of agrochemicals and integrated management. Regarding energy, one of the highlights is the use of alternative sources, such as photovoltaic energy.

Four main themes were identified that could potentially be integrated into the SN: circular economy, biodiversity, agricultural practices, and valorization of DO and territory. The proposal is to establish a multi-year planning, with an annual assessment, within these four themes, establishing a management cycle aligned with the calendar for qualifying DO wines. Planning can be done at individual wineries and also for the region. The format is being evaluated for validation with producers.

The proposal aims to combine flexibility in individual planning for wineries, but at the same time, propose key topics to consider that represent real problems in the wine industry. Thus, the SN should contain a concise and consistent text, which can be further detailed in other supporting regulations or even in a regional sustainability program. In any case, it is important to emphasize that the inclusion of sustainability criteria in the SN is a pioneering initiative in the international context, which shows the region's commitment to its development and sustainability and can be a reference for expanding the discussion and application of sustainability criteria in wine geographical indications and denominations of origin.

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