

# SAFA FAO as an assessment tool for family farming under the sustainability bias

## *SAFA FAO como ferramenta de avaliação da agricultura familiar sob o viés da sustentabilidade*

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### ABSTRACT

The use of Rapid Assessment Protocols can characterise environmental problems such as the degradation of river sources, help understand the socio-environmental scenario of rural communities, and contribute to a more in-depth characterisation of the context and the elaboration of public policies for its solution. This work aims to evaluate the sustainability index (SI) of rural properties using the SAFA tool. Indicators were selected that can contribute to identifying the advantages and limitations of rural properties inserted in a stream micro-basin in Brazil (Barra Grande, Canoinhas, Santa Catarina State). The community generally has a good SI, mainly due to economic resilience and social well-being dimensions, with lowest scores in environmental integrity and good governance. On the other hand, themes that should receive attention to increase the SI of the families are related to the increase of biodiversity in the properties, with an emphasis on forest coverage.

**Keywords:** Socioenvironmental. Sustainability index. SAFA.

### RESUMO

A utilização de Protocolos de Avaliação Rápida pode caracterizar problemas ambientais como a degradação das nascentes dos rios, entender o cenário socioambiental das comunidades rurais, contribuir para uma caracterização mais aprofundada do contexto e para a elaboração de políticas

*públicas para sua solução. Este trabalho tem como objetivo avaliar o índice de sustentabilidade (IS) de propriedades rurais utilizando a ferramenta SAFA. Foram selecionados indicadores que possam contribuir para identificar vantagens e limitações de propriedades rurais inseridas em uma microbacia do córrego no Brasil (Barra Grande, Canoinhas, Santa Catarina). Em geral, a comunidade tem um bom IS principalmente para resiliência econômica e dimensões de bem-estar social, com pontuações mais baixas em integridade ambiental e boa governança. Por outro lado, temas que devem receber atenção para aumento do IS das famílias estão relacionados à elevação da biodiversidade nas propriedades, com destaque para a cobertura florestal.*

*Palavras-chave:* Socioambiental. Índice de sustentabilidade. SAFA.

## 1 INTRODUCTION

The debate over the last four decades on sustainability in rural areas has focused mostly on issues related to the maintenance of natural resources (environmental dimension) and their use in activities that generate the least possible impact on agricultural productivity (economic dimension) without due emphasis on the social and institutional dimensions (HANISCH *et al.*, 2019; POTRICH *et al.*, 2017).

As societies worldwide grapple with increasing challenges to environmental sustainability, questions about what makes knowledge actionable, how we design and fund programs to incentivise it, and how we evaluate the outcomes of its use and societal impact are more relevant than ever (MACH *et al.*, 2020).

Maintaining the balance between socioeconomic and environmental dimensions requires an understanding of economic flows related to the impacts that these actions can generate on the life of the family inserted in each productive system, providing sufficient resources to ensure the well-being of the individual (BENEDICTO *et al.*, 2022). Sustainability analysis is a fundamental strategy and must be carried out with tools that synergistically assess all its dimensions, proposing a continuous process of education and management of the sustainable development of a region, as well as the adoption of good resilient agricultural practices (BENEDICTO *et al.*, 2022; DESA *et al.*, 2016; LOCH *et al.*, 2015).

The great challenge of sustainability analyses has still been the use of adequate tools that adapt to the rural environment's different realities (HANISCH *et al.*, 2019). Interdisciplinary methodological approaches to evaluate the sustainability of complex productive systems relying on natural resources are therefore necessary.

Models facilitate the analysis of the complexity of the agricultural system. However, a well-selected set of indicators that allow the various aspects of its complex nature to be translated into clear, objective and general values constitutes an irreplaceable tool to summarise information and guide farmers' decision-making. (LARSEN *et al.*, 2020).

Several methodologies and models assess farming sustainability in countries (ALVAREZ *et al.*, 2010; BRIQUEL *et al.*, 2001; LÓPEZ-RIDAURA *et al.*, 2000; VIGLIZZO *et al.*, 2006). Among the tools that seek synergy between the four dimensions of sustainability in analysing agricultural systems, the SAFA tool - Sustainability Assessment of Food and Agriculture Systems, Smallholders version (FAO, 2014) has gained prominence. SAFA was developed by Food and Agriculture Organization of the United Nations (FAO) in 2012 to assess the degree of sustainability of agricultural holdings and provide public and private entities with indicators useful for detecting problems and identifying solutions. It is a tool for assessing the sustainability of food and agricultural systems, which sets an international benchmark in identifying the antagonism and synergism between the four dimensions of sustainability (good governance, environmental integrity, economic resilience and social well-being), making it possible to identify and understand the importance of transformations in knowledge management in productive

and social processes (CAMMARATA *et al.*, 2021; ELOI *et al.*, 2018; FAO, 2022; GAYTRI *et al.*, 2016; HANISCH *et al.*, 2019).

Knowing how the productive activities on a rural property impact the dimensions of sustainability is essential to seek strategies to improve the productive model and to contribute to the construction and implementation of public policies that meet the demands not only of the family directly involved but also of the community in the region and surroundings (COLOMBO *et al.*, 2020; CRUZ *et al.*, 2021). This is even more important in municipalities where most of the economy depends on the agricultural sector, especially family farming. In the municipality of Canoinhas, in Santa Catarina State, Brazil, agricultural production is characterised mainly by the cultivation of tobacco, grains, reforestation, and raising of pigs and dairy cattle. More than 70% of these activities come from properties with less than two fiscal modules (TORESAN, 2019).

The integrated tobacco production system, which stands out in the micro basin, follows the principle of mutuality, based on a technical-commercial partnership with the producers, who contract their tobacco crop with the guaranteed purchase of the entire volume produced, and where the company provides specialised technical assistance to farm production and for the economic, social and environmental planning of the property (BRUM *et al.*, 2020). Despite that, farming tobacco is a health risk because its leaves are nicotine rich. Especially in the morning, when air moisture forms dew in the tobacco leaves, water-soluble nicotine is dissolved in that dew water (ALI *et al.*, 2022). Based on this, evaluating the sustainability of rural properties that produce tobacco may help decision-makers in the region promote sustainability by reducing the adverse impacts of tobacco cultivation.

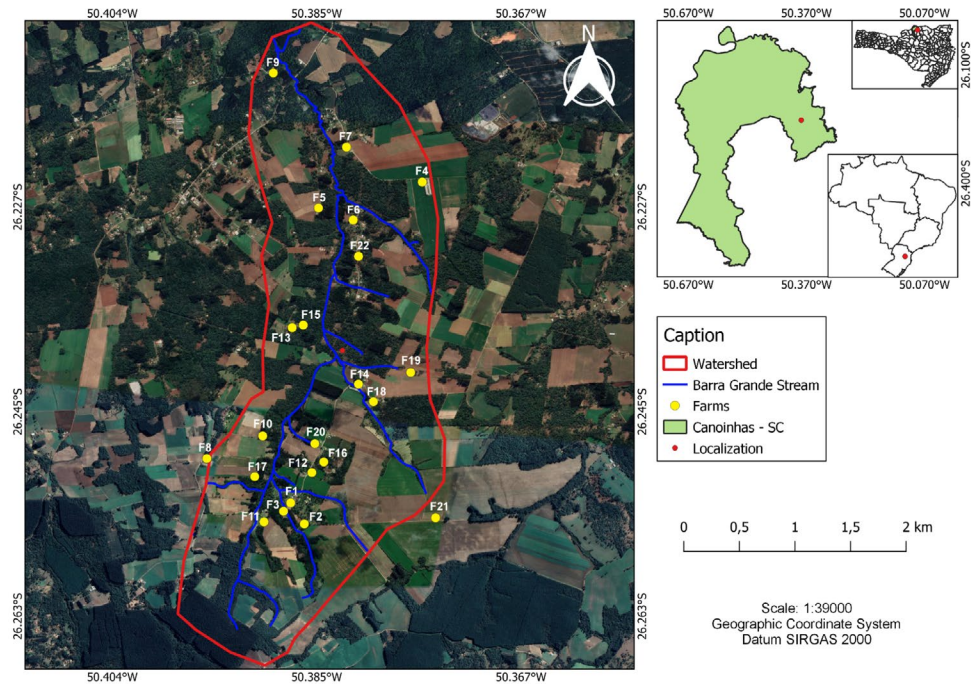
Due to several factors, the conservation of water resources has not been a priority in the rural areas of the region's municipalities over the last few decades, which has contributed to the increasingly frequent appearance of problems related to water scarcity from water courses. (MENICUCCI *et al.*, 2016). Work carried out by various governmental and private Brazilian institutions, mainly Epagri, the Agricultural Research and Rural Outreach Company of Santa Catarina, and the Canoinhas River and Negro River tributaries Committee, within the scope of environmental education and preservation of the environment, has sought to reverse this situation with the communities most affected by this type of problem.

Public engagement is understood as a prerequisite for sustainability transitions. However, it has remained peripheral to the transitions research agenda and the efforts to engage citizens in transitions research remain scattered. Thus, there is a need to create a more holistic understanding of how citizens participate in knowledge co-creation for sustainability transitions (HUTTUNEN *et al.*, 2022). Participatory governance involves relationality between those entrusted with formal governance of natural resources and those who directly use, benefit from, and impact natural resources (PALMER *et al.*, 2022). Based on the exposed, a work carried out with the Community of Salto da Água Verde, in the rural area of Canoinhas, Santa Catarina State, Brazil, stands out, where the observation of the low volume of water in its mainstream, due to the excess of sediments in its bed, associated with the absence of surrounding vegetation led to the development of more intense inter-institutional work in the watershed. Based on studies and articulations of these institutions, a revitalisation plan for the Barra Grande stream was initiated, directly involving 22 families of family farmers, who represent approximately 40% of the families residing in the watershed of the Barra Grande stream.

Thus, the present work aims to evaluate these rural properties' sustainability index, SI, using the SAFA tool. For this, indicators were selected that can contribute to identifying the advantages and limitations of rural properties inserted in the Barra Grande stream micro-basin and contribute to the strengthening of environmental recovery actions of the same and the better quality of life of the community.

## 2 METHODOLOGICAL PROCEDURES

The study area comprises the delimitation of the hydrographic micro-basin of the Barra Grande stream, between the coordinates 26.21° and 26.27° South latitude and 50.40° and 50.37° West longitude, located in the Canoinhas River Hydrographic Basin, located in Hydrographic Region 5 (RH5) of the state of Santa Catarina, Brazil, known as Planalto de Canoinhas, with an area of 932.62 hectares (PERH/SC, 2017; SANTA CATARINA, 2013) (Figure 1).



**Figure 1** | Canoinhas Region, North Plateau of Santa Catarina, Brazil, with emphasis on the watershed of Córrego Barra Grande and the location of surveyed farms.

*Source: Authors.*

To collect the information, a questionnaire was applied based on the SAFA tool (Sustainability Assessment of Food and Agriculture Systems) Smallholders version, consisting of seventy questions related to perceptions regarding economic and environmental sustainability, governance and social well-being of the families included in the community. The 70 questions are divided into 4 dimensions, 20 themes and 32 indicators (Table 1). All points evaluated in the survey were selected because they correlate with the community's reality and which production systems are developed on the rural property.

**Table 1 |** Dimensions, themes and sustainability indicators selected from the SAFA tool, for the elaboration of the diagnosis used in the 22 families of the Barra Grande Community in Canoinhas, Santa Catarina State, Brazil, 2022

<i>Dimension</i>	<i>Subject</i>	<i>Indicator</i>
<b>Good Governance</b> (9 questions)	Corporate Ethics	Mission Knowledge
	Social Accounting	Social Accounting
	Participation	Participation
	Holistic Management	Sustainable Management Plan
	Legal aspects	Land ownership and use rights
<b>Environmental Integrity</b> (27 questions)		GHG mitigation practices
		Air pollution prevention practices
		Soil improvement practices
		nutrient balance
	Atmosphere	Area conservation and recovery practices
	Materials and Energy	Water conservation practices
	Ground	Water pollution prevention practices
	Water	Pesticides
	Product Quality and Information	Ecosystem diversity
	Biodiversity	Species conservation practices
		Genetic conservation of seeds and breeds
	Renewable and recycled materials	
	Energy use and consumption / Renewable energy	
<b>Economic Resilience</b> (19 questions)		Profitability
		Production Diversification
	Investment	Market Stability
	Vulnerability	Liquidity
	Product Quality and Information	Safety Nets
		Food Quality
		Certified Products
<b>Social Welfare</b> (15 questions)		Fair Pricing and Transparency in Contracts
	Fair Trade Practices	Safety in the Workplace, Operations, And Facilities.
	Human Health and Safety	Capacity Development
	Decent Life	Gender Equity
	Equity	Food Sovereignty
	Cultural Diversity	Traditional Knowledge
	Quality Of Life	

Source: Adapted from HANISCH et al., 2019.

The score for each theme was determined according to the SAFA criteria, where the question for each indicator can have the answers: yes, no, partial or percentage calculation. Each response was transformed into a percentage, generating a sustainability index that can be classified as: Great > 80% represented by the dark green colour; Good: from 79 – 60% (light green); Moderate: from 59 – 40% (yellow); Limited: from 39 – 20% (orange); Unacceptable < 20% represented in turn in red colour.

The survey was carried out virtually after approval by the Ethics Committee for Research with Human Beings (CEPSH – IFC SC) in February and March 2022. The questionnaire was applied via the Google Forms platform, and firstly the farmer read the Free and Informed Consent Form (TCLE) and, agreeing, answered the research questions. Assurance of your integrity and that your participation will not present you with any physical, social or financial risk, and your responses will be kept confidential. Completing the questionnaire in full took approximately 30 (thirty) minutes, varying according to the individual rhythm.

The collected data were transferred to the Microsoft Excel program, where the analysis of the averages of each group and the elaboration of the “radar” type graphs suggested by FAO for the SAFA model were carried out. Graphs were prepared with the average response for each of the 70 guiding questions and presented according to the indicators defined for each dimension.

### 3 RESULTS AND DISCUSSION

Despite the spatial proximity of the rural properties (Figure 1), there was a considerable difference in the sustainability indices between them, which ranged from 48.14 (property B) to 87.44 (property G) and can be better visualised in the polygon’s individual of each (Figure 2).



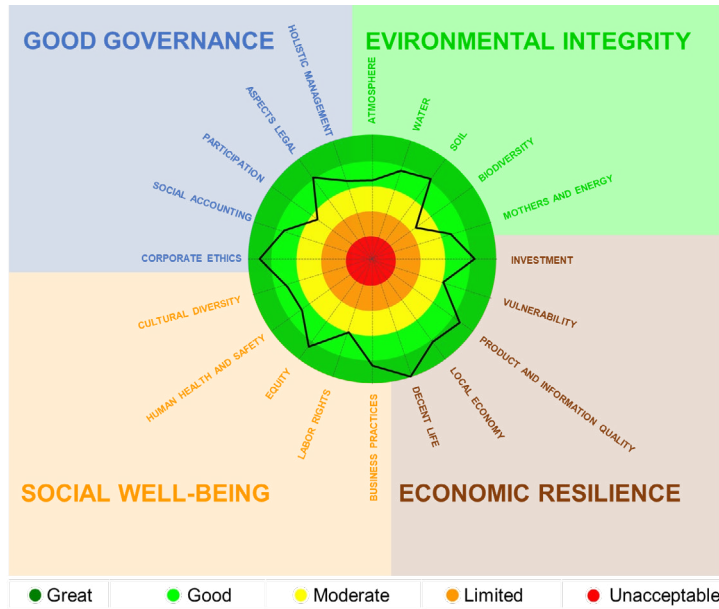


**Figure 2]** Graphical representation and sustainability index (represented by the value next to the letters from A to V) of 22 rural properties in the Barra Grande Community in Canoinhas State, Brazil, 2022. The highlighted polygon reflects the performance of each indicator evaluated by through the guiding questions; the colours represent the performance of the indicator: Great > 80% (dark green); Good: from 79 – 60% (light green); Moderate: from 59 – 40% (yellow); Limited: from 39 – 20% (orange); Unacceptable < 20% (red).

Source: Authors.

Despite the variability between properties, it is possible to verify that, in the average of the 22 properties, most of the evaluated indicators are found in the green zone, classified as good (Figure 3).

The lowest sustainability indices were obtained in the dimension of Good Governance, with emphasis on the theme of “participation”, followed by the theme of “biodiversity” in the dimension of Environmental Integrity, which contributed to the average value of these dimensions being below 70% (Figure 3 and Table 2). The dimensions of Economic Resilience and Social Well-Being reached high averages, indicating that the quality of life in the community tends to be high.



**Figure 3 |** Overall performance of the sustainability analysis of 22 rural properties in the Barra Grande Community, in Canoinhas, State, Brazil, 2022. The highlighted polygon reflects the performance of each indicator evaluated through the guiding questions.

Source: authors

**Table 2 |** Average sustainability index of the 22 properties in the Barra Grande Community in Canoinhas State, Brazil, and average value per analysed dimension, according to the SAFA tool.

Dimension	Subjects	Sustainability Index	Mean Value
Good governance	Corporate ethics	81,82	68,94
	Social accounting	65,91	
	Participation	43,18	
	Legal aspects	79,55	
	Holistic management	74,24	
Environmental integrity	Atmosphere	63,07	67,64
	Water	65,91	
	Ground	80,68	
	Biodiversity	54,17	
	Materials and energy	74,35	



<i>Dimension</i>	<i>Subjects</i>	<i>Sustainability Index</i>	<i>Mean Value</i>
<b>Economic resilience</b>	Investment	90,34	79,42
	Vulnerability	71,28	
	Product quality and information	69,70	
	Local economy	86,36	
<b>Social well-being</b>	Decent life	61,36	78,91
	Fair trade practices	85,23	
	Labor rights	98,86	
	Equity	81,82	
	Human health and safety	86,36	
	Cultural diversity	59,85	

*Source: Authors.*

### 3.1 GOOD GOVERNANCE

The Good Governance dimension can be understood as a horizontal dimension directly affecting other dimensions (GAYATRI *et al.*, 2016). The good performance in this dimension in the group's average is because the families work mainly with tobacco growing, which raised the averages in the themes of corporate ethics, legal aspects, and holistic management. The dynamics of tobacco growing are linked to integrating companies that are very strict throughout the production process, seeking to comply with the relevant legislation. In addition, as integrators provide technical and commercial support, all managerial issues are also adequately worked on with families.

On the other hand, the low average value obtained for the group of 22 families for the theme "participation" indicates little interaction between families and the community. For Cammarata *et al.* (2021), participation refers to the process of involving all interested parties and is characterised by dialogue and the generation of procedures for conflict resolution, without the risk of negative consequences, based on respect, mutual understanding, and equality. In the presentation of the graph by family, it is possible to verify that this theme was low even for families with a high sustainability index (Families B, C, D, G, H, J, K, L, P, T and U).

In the diagnosis, the participation theme was linked to the question related to the involvement of a family member in representative entities of the rural environment, such as cooperatives, associations, and unions. The fact that it was very low for several families indicates their individualism, which may also be related to the fact that they work with integrating companies, which, by their nature, tend to solve all problems directly with the integrated family.

On the other hand, it is interesting to point out that, due to a problem common to the entire community, which was the reduction in the availability of water in its mainstream, there was considerable involvement of everyone in projects related to environmental recovery, as a strategy to seek a joint resolution. This fact confirms the importance of working to increase awareness and individual commitment to sustainability issues. (SOLDI *et al.*, 2019).

### 3.2 ENVIRONMENTAL INTEGRITY

In this dimension, three themes obtained SI less than 70 (atmosphere, water, and biodiversity), and the SI of biodiversity, of 54.17 was the lowest of all the themes addressed in the diagnosis. These results are in accordance with the community's current situation since it was the search for the recovery of its

main body of water that is degraded. In addition, the results prove the efficiency of the SAFA diagnosis in detecting problems in the different dimensions of sustainability. This is visually confirmed in the individual polygons of the properties, where, except for property M, all the others have a lower score in the environmental dimension (Figure 3).

Interestingly, in the theme “soils”, the average SI was 80.67, indicating that the families understand that they adopt soil conservation practices (Table 2). However, the silting up of the body of water indicates that these practices may have implementation problems, which in turn requires an effort from the technical assistance institutions involved to detect the problems. It is very common in the region that the practice of minimum cultivation is understood as direct planting. However, avoiding soil preparation operations in minimum cultivation does not prevent the loss of water and soil since this practice is not validated by the presence of a significant amount of vegetation cover on the soil and is often carried out without respecting the natural unevenness of the terrain.

Regarding biodiversity, the low SI indicated that virtually all properties lack an organised environmental conservation plan. This theme addressed issues related to plant conservation and species diversity that contribute to establishing balance within the agro-ecosystem. The silting up of the water body refers precisely to preserving the riparian forest.

The good assessment of materials and energy is the result of investments in systems that have generated electricity savings in recent decades, both in greenhouses for drying tobacco and for use on properties. For the SAFA diagnosis, the two fundamental aspects of this thematic area are the share of recycled and renewable materials and the reduction of the material intensity of production (CAMMATTÀ *et al.*, 2021). Indeed, it was possible to detect that some properties have been adopting a source of solar energy, for example. In addition, most families are concerned with the disposal of pesticide packaging in compliance with relevant legislation and the use of inputs in accordance with technical recommendations.

The negative highlight for this dimension is related to the predominance of monoculture with tobacco cultivation, with the scheduled use of fertilisers and pesticides, and due to this great dependence on external inputs.

### 3.3 ECONOMIC RESILIENCE

The fact that most families practice agriculture based on tobacco production, the dimension of economic resilience is positively impacted, with the highest sustainability index, which was SI 79.42, with emphasis on financial investment themes on properties SI 90.34 and contribution to the local economy SI 86.36 (Table 2). Families, in general, demonstrated knowledge about expenses with activities carried out on the property, monitoring the cost of production, in addition to having a good estimate of profitability. This is an important factor for the permanence and autonomy of families in rural areas since, more autonomous and aware, producers feel less vulnerable to the market (COLOMBO *et al.*, 2020; ELOI *et al.*, 2018).

The productive system of tobacco cultivation has a large commercialisation network. There are, however, some negative aspects in relation to the setting of prices by integrator companies and their relationship with the classification of the final product. In recent years, marketing problems related to prices have been recurrent, even when the producer presents a final product of excellent quality. However, this fact is highlighted by the SI 69.70 (Table 2), the lowest in this dimension.

In the SAFA tool, investments are seen from a microeconomic perspective and are understood as the portion of the money spent on improvements that can make the farm more sustainable because by allocating money for the purchase of new land or equipment, the properties improve their capacities

and long-term profits (CAMMARATA *et al.*, 2021). This is necessary to keep them competitive. Based on the above, practically all families presented high values for the investment theme. This fact is related to tobacco companies' offers of lines of credit. In the same way, most of the families that participated in this diagnosis declared that they had some risk management plan, agricultural insurance or even some financial reserve, aiming to minimise losses with possible weather events, especially the risk of hail, a relatively common fact in the region.

### 3.4 SOCIAL WELL BEING

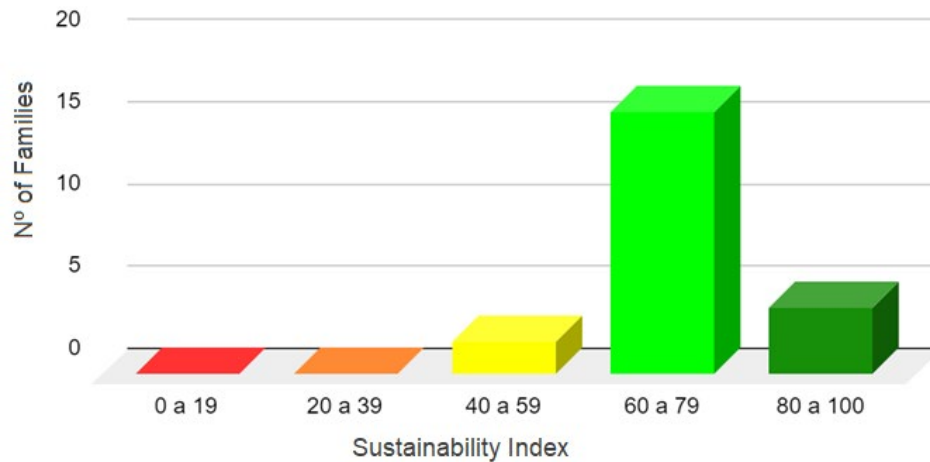
In the dimension of social well-being, it was possible to identify how families advanced in the issue of "fair trade practices" and "equity", with SI of 85.23 and 81.82 being results related to tobacco production, which has a well-defined and well-consolidated strategy for purchasing products and legal obligations to be followed by integrated families. In this dimension, on the other hand, the low rates in the theme "decent life" and "cultural diversity", with SI of 61.32 and 59.85, respectively, drew attention. In a way, there is also a certain relationship with the tobacco culture, which demands a large workforce, for a long period of the year, leaving little time to invest in activities that bring a better quality of life. Most properties do not hire labour, but when this is done, rural producers prioritise hiring people from the community, contributing to the local economy.

The social well-being dimension also maintained a good level, where "human health and safety" and "labour rights" are points respected by family members. Being a determinant for the quality of life of families, which includes aspects related to healthy eating, safe housing, time in which the family intends to remain together, and time for leisure, in addition to physical and financial security (ELOI *et al.*, 2018).

The surveyed community generally performs well in terms of the evaluated dimensions. The diagnosis tends to facilitate the discussion on which the families should prioritise topics to increase the sustainability of the properties and, consequently, the community. Undoubtedly, depending on the theme being worked on, attention should be paid to environmental integrity, with an SI of 67.64 and good governance, with an SI of 68.94 (Table 2). In environmental integrity, applying soil and water conservation practices, with training, lectures, and courses, applied by public and private institutions favours awareness and consequently an environmental improvement. To improve the dimension of good governance, the main point is the integration between families, which through work groups, can develop meeting routines to seek support from institutions that can help with difficulties encountered in the community.

In addition, in the dimension of social well-being, it highlights points that can be used by the community, together with the public sector, to propose and develop strategies for the implementation of public policies that allow access to culture to provide a more decent life, which had a low rating in the survey.

Although the focus of the research project was to build a vision of the sustainability of the community, there is undoubtedly an invaluable value in the individual analysis of each of the families since this data can be of great value in rural extension and implementation work of public policies. The fact that most families are at good and optimal levels of sustainability (Figure 4) allows the government to focus more heavily on families with lower IS and allows greater optimisation of efforts in the themes detected as problems for each participating families. The result of the proper use of tools such as SAFA can be a starting point for discussion, reflection, and learning, clearly indicating where each family can act to improve their sustainability indexes (OLDE *et al.*, 2016).



**Figure 4|** Number of families in the Community of Barra Grande, in Canoinhas State, Brazil, at each level of the sustainability index, according to the SAFA tool.

Source: Authors.

Finally, it was possible to observe that the use of the SAFA tool to evaluate the sustainability of the properties results in objective information, highlighting positive and negative aspects in a visual way of easy understanding and interpretation, always in the search for themes that can be worked on and implemented in the productive systems and properties evaluated similarly to those observed by other authors who used it (COLOMBO *et al.*, 2020; ELOY *et al.*, 2022; HANISCH *et al.*, 2019; POTRICH *et al.*, 2017). While a SAFA has a default set of indicators to ensure a holistic approach, it is also important for the assessor to identify critical areas based on materiality principles for the context of that entity.

## 4 CONCLUSIONS

Based on the farmers' perceptions, it was observed that families within the same watershed have different positions that can determine better or worse IS.

The use of the SAFA tool identified that there is, in the evaluated community, a good IS, despite the problems that exist in the environmental dimension, confirming the importance of analysing sustainability in rural areas using the evaluation of the four dimensions.

Sustainability scores were highest on the dimensions of economic resilience and social well-being, with lowest scores on environmental integrity and good governance. The themes that should receive more attention for the increase of the SI of the families are related to the increase of the biodiversity in the properties, with emphasis on the forest coverage and the development of strategies that increase the participation of the families in the different forms of organisation and joint resolution of problems.

The SI obtained with the SAFA tool can be used as a basis for structuring and improving the analysed rural properties and can be replicated in other properties, obtaining an adequate standard to indicate improvements for the members of the analysed rural properties.

Despite the efficiency, applicability, and minimised cost of doing a SAFA, making the best use of existing data from other sustainability, environmental and social management, a validation, in the field, by remotely collected information is recommended.

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