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EDITED BY
Bruno José Rodrigues Alves,
Brazilian Agricultural Research Corporation (EMBRAPA), Brazil

REVIEWED BY
Doriana Eurosia Angela Tedesco,
University of Milan, Italy
Gaetano Chinnici,
University of Catania, Italy

*CORRESPONDENCE
Stefan Burkart
✉ s.burkart@cgiar.org

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# Sustainable beef labeling in Latin America and the Caribbean: Initiatives, developments, and bottlenecks

Leonardo Moreno Lerma[1], Manuel Francisco Díaz Baca[2] and Stefan Burkart[2]*

[1]Independent Consultant, Cali, Colombia, [2]The Alliance of Bioversity International and CIAT, Cali, Colombia

Scientific research is increasingly conclusive regarding the responsibility of food production in environmental issues, a situation that contrasts with greater consumer awareness. In this context, sustainability labels for meat have emerged, which offer a guarantee that production is based on principles of animal welfare, and carbon neutrality, among others. Since research on this subject is scarce, the objective of this article is to identify and analyze the initiatives and development of this type of labeling in Latin America and the Caribbean. For this purpose, a qualitative-descriptive study is carried out based on primary and secondary sources. The results show different types of progress in the main producing countries, with Uruguay and Brazil standing out as success stories. At the same time, difficulties are highlighted in the different stages of the production chain, such as low demand, or traceability. It is concluded that, despite the challenges, the transition to sustainable cattle farming is inevitable. However, this process will not happen spontaneously, but must be coordinated up with other types of strategies and the actions of various actors including governments, policymakers, and NGOs.

KEYWORDS

**sustainable labeling, sustainable intensification, sustainable livestock farming, animal welfare, carbon neutrality**

## 1. Introduction

Currently, citizens around the world are expressing strong concern about environmental issues such as deforestation, biodiversity loss, natural resource exploitation, and climate change, among others (European Environment Agency, 2015; Cantú-Martínez, 2020; Pérez et al., 2021). This sentiment is the reflection of alarming data for different environmental indicators. Since the Industrial Revolution, greenhouse gas (GHG) emissions have exceeded the values for the previous 10,000 years, which has caused an atmospheric accumulation of large amounts of carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$) (Mendoza et al., 2020). As a result, the global temperature increased by 0.87°C between 2006 and 2015 in relation to the period 1850–1900, which has caused cyclones, heat waves, floods, and fires, among other meteorological phenomena (IPCC, 2019). The World Wildlife Fund (2020) points out that the 3,471 species evaluated by the Living Freshwater Planet Index, which includes 944 species of reptiles, birds, amphibians, fish, and mammals, have declined between 77% and 89% since 1970. These losses have occurred in all regions of the planet, but particularly in Latin America and the Caribbean (LAC). The World Wildlife Fund (2020)

states that plant diversity has been considerably reduced and that 22% of the species are in danger of extinction.

Although these figures correspond to many factors, food production has a high share of responsibility. As stated by Sala et al. (2017), supply chains are increasingly associated with environmental and socioeconomic impacts at various stages, from production to distribution, consumption, and waste generation. Benton et al. (2021) point out that the agricultural sector contributes to climate change by generating approximately 30% of anthropogenic GHG emissions. In addition, the sector uses 70% of the global freshwater, causes 80% of the global deforestation, and is responsible for 70% of the loss of terrestrial and 50% of freshwater biodiversity (World Wildlife Fund, 2020). This has caused food production to be at the center of attention of the Sustainable Development Goals (SDGs) and the Paris Agreement (FAO, 2019). However, beyond these macro agreements, environmental issues have awakened the awareness of citizens in recent decades, motivated by the interest in reducing the negative impacts of consumption (Sabio and Spers, 2022), giving rise to socially responsible consumption (Izquierdo et al., 2018). This is understood as the choice of products and services not only considering their quality or price, but also their environmental and social consequences, as well as the behavior of the companies that offer them. Sesini et al. (2020) emphasize a series of relevant factors for this type of consumer, which include having a positive impact on life cycle, achieving a balance between the wellbeing of present and future generations, or contributing to the long-term conservation of the planet. Some authors even allude to moral obligation, where the buyer judges his behavior as good or bad (Müller et al., 2021). The concern of consumers is especially apparent with respect to beef consumption because its production generates GHG emissions, has a negative impact on climate change, and causes loss of biodiversity, among others (Machovina et al., 2015; Eldesouky et al., 2020). This represents a challenge for the cattle sector in the face of the offer of vegan and vegetarian products, or sustainable protein substitutes with lower prices (Košičiarová et al., 2022).

Such attitudes have been addressed in purchase preference studies in different countries. For example, research by Spain et al. (2018) reveals that 70% of the studied consumers in the United States consider food labels in relation to animal welfare. In Spain, Eldesouky et al. (2020) identified that the best option for consumers is organic beef produced in the country, with the guarantee of national origin being an aspect of high relevance. Research developed in Mexico by López (2019) states that 70% of the approached consumers are willing to pay a 5% price premium if animal welfare, preserving the fertility of the land, or less environmental pollution are guaranteed. Likewise, in Colombia, Charry et al. (2019) showed that beef consumers are willing to pay up to 40.2% more for beef that guarantees ecological and animal welfare criteria. The study also showed that consumer willingness to pay increases by 10% if information on the environmental impacts of the sector is provided. In Paraguay, Vega et al. (2019) indicate that 46.88% of the surveyed consumers would pay price premium for a geographical indication attribute, with values ranging between 5% and 20%. In Brazil, Conceição et al. (2020) found that 80% of the studied consumers would pay price premiums for animal welfare guarantees.

To respond to new consumer demands, bioeconomy and sustainable intensification have become important concepts for public and private food system actors. Bioeconomy aims at generating contributions in terms of mitigation and adaptation to climate change, management of vital resources and preservation of biodiversity, as well as economic and employment growth (Hodson, 2018). Sustainable intensification of cattle production is an approach that seeks to increase productivity while generating ecosystem services (such as GHG reductions, soil quality improvement, sedimentation and erosion reduction, among others) (Rao et al., 2015). Both consider the three axes of sustainability: planet, people, and profits (Tedeschi et al., 2015).

As a way to showcase their commitment to the sustainable intensification approach, food companies, public entities, and NGOs are focusing on the development of sustainability labels. Such labels are voluntary certifications that offer consumers the opportunity to take environmental and ethical aspects into consideration when choosing their products (Grunert et al., 2014; Praneetvatakul et al., 2022). In this regard, labeling in both the beef sector and food sector in general can be classified into two types: the first is mandatory labeling which provides information on nutritional composition or expiry dates. The second is voluntary labeling which can be self-declared or issued by third parties that guarantee the independence of the certification (GIZ, 2017). Sustainability labels fall under the second category.

Sustainability labels have spread in different regions of the world, such as the United States, Europe, and LAC. In the United States, labels are divided into regulated and non-regulated ones. The United States Department of Agriculture (USDA) and the Food and Drug Administration (FDA) oversee the certification process. Regarding non-regulated labels, they are limited to "sustainably raised" type claims and do not involve any governmental verification (Tedrow et al., 2018). Among the national labels, Rainforest Alliance Certified (issued by the Sustainable Agriculture Network) and USDA Organic

Abbreviations: CH4, methane; CIAT, International Center for Tropical Agriculture; CO, Colombia; CO2, Carbon dioxide; DNA, Deoxyribonucleic acid; ECLAC, Economic Commission for Latin America and the Caribbean; EU, European Union; FAO, Food and Agriculture Organization of the United Nations; FDA, Food and Drug Administration; Fedegán, Federación Colombiana de Ganaderos/Colombian Cattle Farmers Federation; Ganso, Ganadería Sostenible/Sustainable Cattle; GHG, Greenhouse gas; GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit/ German Corporation for International Cooperation; ICONTEC, Instituto Colombiano de Normas Técnicas y Certificación/Colombian Institute of Technical Standards and Certification; IDB, Inter-American Development Bank; IICA, Inter-American Institute for Cooperation on Agriculture; INAC, Instituto Nacional de Carnes/National Meat Institute of Uruguay; INPI, Instituto Nacional da Propriedade Industrial/National Institute of Industrial Property; LAC, Latin America and the Caribbean; N2O, Nitrous oxide; NAMI, North American Meat Institute; NGO, Non-Governmental Organization; ONAC, Organismo Nacional de Acreditación de Colombia/National Accreditation Body of Colombia; PCNCU, Programa Certificado Nacional de la Carne de Uruguay/ Certified Natural Meat Program of Uruguay; SDGs, Sustainable Development Goals; UN, United Nations; USDA, United States Department of Agriculture; WWF, World Wildlife Fund.

(granted through the USDA) stand out, both with a sustainability component (GIZ, 2017). Likewise, the Food Alliance Certified label (granted by the Food Alliance) stands out, which guarantees that farmers and ranchers promote fair labor conditions for workers, assure animal welfare standards, do not use genetically modified organisms, and contribute to soil and water preservation (Food Alliance, 2021). Europe has also developed a set of sustainability labels. One of the most relevant is the EU Organic Logo, awarded by the European Union through the Directorate-General for Agriculture and Rural Development. The label includes different foods (among them beef) and aims at ensuring environmental and animal welfare standards, such as a restricted use of pesticides or free-range cattle farming (GIZ, 2017). In Germany there is *Naturland* Fair, awarded by *Naturland*, which guarantees organic production, optimal working conditions, fair trade, and respect for human and children's rights (Naturland, 2021). Likewise, in the Netherlands, the Better Life label has been implemented for guaranteeing animal welfare (Beter Leven, 2021).

The purpose of this article is to identify and analyze the development and implementation of sustainability labels for cattle farming in LAC from a macro- and cross-country perspective. The aim is to (i) provide an overview on both existing labels and labels under development, with a particular emphasis on providing information on the basic sustainability guarantees they offer, the entities in charge of certifying, and some advances on the certification made so far; (ii) to compare, where possible, the advances and challenges made with sustainability labeling across the different countries; (iii) highlight the particular advances made in selected countries (i.e., Brazil, Uruguay, and Colombia) as regional benchmarks, and (iv) provide lessons learned from the development and implementation of sustainability labels for improving future endeavors. This implies taking several aspects into consideration, namely (i) the differentiation between labels issued by private companies and those granted by independent entities; and (ii) the identification of the primary objectives of the labels, i.e., animal welfare, zero deforestation, biodiversity conservation, and fair payment, among others. The study is a review that retrospectively analyzes research on a specific topic (Reyes, 2020), and follows a qualitative approach for which an exhaustive review of literature and documents on sustainability labels in LAC and expert interviews were applied. Hernández et al. (2014) point out that a qualitative analysis addresses the subject in all its dimensions (internal and external, past, and present), while placing great value on the point of view of the individuals involved. Regarding the descriptive character, the same authors state that such research is useful to express the different angles of the object of analysis. Both aspects are fundamental, since the characterization of sustainability labels implies considering a set of factors from context and developments over time, to the institutional actors' perspectives. The study provides valuable inputs for the development of new labels, while seeking to contribute to the strengthening of existing ones.

The article is structured as follows: Section 1 provides a short introduction and the objectives of this research. Section 2 delves into the methodology by presenting the approach, type of sources, data collection technique, instruments, and limitations. Section 3 provides the results, analysis, and discussion and is divided into five subsections: 3.1 provides a brief overview on the cattle sector in LAC; 3.2 gives an overview on the identified sustainability labels; 3.3 describes in detail the advances made in Brazil and Uruguay as regional benchmarks; 3.4 focuses on the sustainability labels in Colombia, which are emerging over the last years; and 3.5 analyzes the lessons learned in the implementation of the labels. Section 4 presents recommendations and Section 5 concludes.

## 2. Materials and methods

Research was carried out in several stages. The first stage dealt with the identification of all meat labels in Latin America and the Caribbean that include aspects of sustainability. For this, a

TABLE 1 Identified labels at the regional level (LAC).

| Country | # of identified labels | Country | # of identified labels |
|---|---|---|---|
| Antigua y Barbuda | 0 | Haiti | 0 |
| **Argentina** | **1** | Honduras | 0 |
| Aruba | 0 | Jamaica | 0 |
| Bahamas | 0 | Martinique | 0 |
| Barbados | 0 | Mexico | 0 |
| Belize | 0 | Montserrat | 0 |
| Bermudas | 0 | Nicaragua | 0 |
| **Bolivia** | **1** | Panama | 0 |
| **Brazil** | **2** | Paraguay | 0 |
| Cayman Islands | 0 | Peru | 0 |
| Chile | 0 | Puerto Rico | 0 |
| **Colombia** | **4** | San Bartolome | 0 |
| Costa Rica | 0 | Saint Kitts and Nevis | 0 |
| Cuba | 0 | St. Vincent | 0 |
| Dominica | 0 | St. Lucia | 0 |
| Dominican Republic | 0 | Surinam | 0 |
| Ecuador | 0 | Trinidad and Tobago | 0 |
| El Salvador | 0 | Turks and Caicos Islands | 0 |
| Falkland Islands | 0 | **Uruguay** | **2** |
| French Guyana | 0 | Venezuela | 0 |
| Granada | 0 | Virgin Islands (U.S.) | 0 |
| Guadalupe | 0 | Virgin Islands (UK) | 0 |
| Guatemala | 0 | **International labels** | **2** |
| Guyana | 0 | **Total** | **12** |

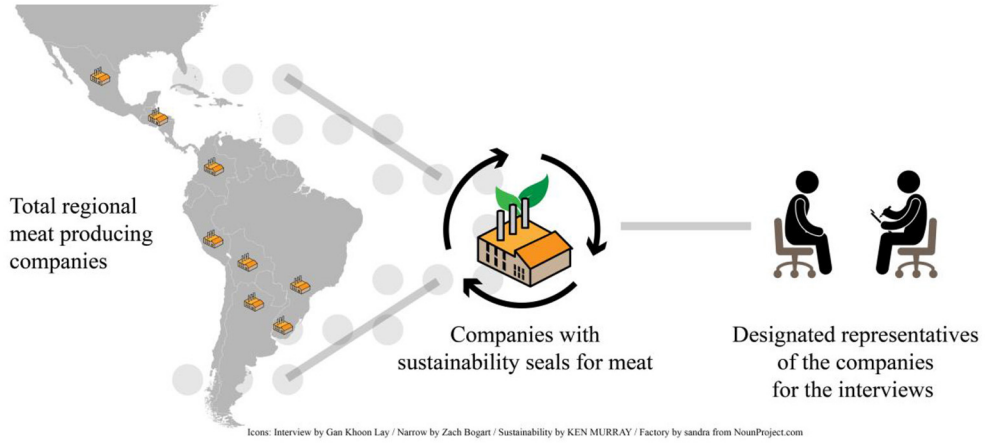


FIGURE 1
Total population and sampling method: convenience sampling.

bibliographical review was carried out for each country, prioritizing the documents published by the promoting entities of the labels, such as spreadsheets and reports. By this, twelve national labels corresponding to five countries as well as two international labels were identified (Table 1). In the second stage, a semi-structured interview format was designed and used for the representatives (both administrative and technical) of the organizations promoting the identified labels in stage one (Annex 1). The interviews were conducted virtually *via* MS Teams and lasted ∼15–20 min per interviewee. A total of 15 representatives were interviewed (see Figure 1 for the interview process). The obtained information was anonymized and is cited as "personal communication". Both the questionnaire and methodology were approved by the Ethics Committee of the Alliance of Bioversity International and CIAT, and before conducting the interview, respondents were asked for consent. In the third stage, the obtained information was organized and analyzed, applying content analysis. For this, the respective countries and year of launch of each label were considered (Table 2). In the analysis, the experiences documented for Brazil and Uruguay were highlighted since the largest number of sustainability labels for beef were found there and their experiences have been consolidated for several years already. The Colombian case was also addressed in a particular way because four labels have emerged since 2020, making the country's commitment with sustainable cattle stand out at the regional level. To these sections, a context section on cattle in LAC was prepared, as well as an overview with the hallmarks identified and the lessons learned in the implementation processes of the sustainability labels.

In addition to the consulted primary sources, the study focused on three types of secondary sources, namely (i) scientific articles, (ii) documents from international organizations (e.g., FAO, IICA, ECLAC), and (iii) publications provided by the organizations promoting the identified sustainability labels. The collection of primary and secondary sources was carried out between July and November 2021.

Three aspects stand out as limitations of the study. Firstly, difficulties occurred in obtaining information from primary sources, as some of the representatives of the labeling organizations were not available. Consequently, the description of these labels was carried out using secondary sources. Secondly, although the analyzed labels correspond to the concept of sustainability labeling, differences are large in terms of objectives, types of certifying organizations, implementation periods, and even the context of application. In this sense, it was not possible to determine criteria applicable to all the labels, since each one corresponds to a particular form of sustainability (carbon neutrality, animal welfare, etc.), making systematic comparisons difficult. Lastly, some labeling entities preferred not to reveal the numbers of certified beef producers nor the quantities of sold or exported certified beef, which limited measures regarding the impacts and success of certified.

TABLE 2 Identified labels per country in LAC.

| Country | Label | Year of launch |
|---|---|---|
| Argentina | Grass fed | 2021 |
| Bolivia | Bolivian natural beef | 2017 |
| Brazil | Carbon neutral Brazilian beef | 2015 |
| Brazil | *Angus Sustentabilidad* | 2019 |
| Colombia | *Aval Ganso* | 2020 |
| Colombia | Colombian beef: grass-fed CO | 2020 |
| Colombia | *Sello de Ganadería Sostenible* | 2021 |
| Colombia | *Sello Ambiental Ganadero* | 2021 |
| Uruguay | Never ever 3 | 2014 |
| Uruguay | Carbon neutral meat | 2021 |
| International: Brazil, Uruguay | Certified Humane | 2008 |
| International: Argentina, Brasil, Paraguay, Uruguay | *Carne del Pastizal* | 2010 |

# 3. Results, analysis, and discussion

## 3.1. Context of the beef sector in LAC

The cattle sector in LAC contributes more than 25% of the global beef and 10% of the global milk production (ECLAC et al., 2017, 2019). The region's potential is so great that Brazil, Argentina, and Mexico are the second, fifth and sixth largest beef producers (Statista, 2021). It is noteworthy, that between 2000 and 2016, regional exports of all types of meat (except lamb) increased, with Paraguay and Uruguay playing a leading role, selling 60% of their production abroad (ECLAC et al., 2017). The growth of several emerging economies, such as China and Russia, has increased exports to those markets, further strengthening the sector (IDB, 2018). Likewise, it is noteworthy that the decline in both cattle inventories and beef production in the United States between 2000 and 2016 was made up for by LAC, which increased in both these indicators by 17% and 31.5%, respectively (ECLAC et al., 2017).

This situation represents benefits in multiple ways. On the one hand, cattle production and exports contribute to the livelihoods of poor families in the region, as well as to the overall economy of the countries (FAO, 2019). As noted by Rodríguez et al. (2016), the strengthening of the sector has generated job opportunities and income throughout the production chains, including processors, transporters, retailers, exporters, and related industries. Food security is another of its major contributions, since moderate meat consumption provides important macro and micronutrients for humans, such as proteins, fats, vitamins B and D, iron, and zinc (Scollan et al., 2017; Cocking et al., 2020). To this extent, the cattle sector is key in the achievement of the SDGs, particularly those related to the eradication of poverty and hunger (SDGs 1 and 2) (ECLAC et al., 2017).

Despite these aspects, cattle production in LAC has negative impacts on the environment, such as on soil degradation (Mora et al., 2017), destruction of wetlands (Rodríguez et al., 2017), deforestation (Armenteras and Rodríguez, 2014), GHG emissions (Molina et al., 2019), and loss of biodiversity (Marques et al., 2019), to which the challenge of providing animal welfare conditions is added (Muñoz, 2014). According to Calle et al. (2012), the development of the sector has caused the loss of forests, in addition to favoring practices based on pasture monocultures that contribute to climate change. Among the regions most affected by deforestation is the Amazon, which went from having a cattle herd of 47 million in 2000 to one of 85 million today, in addition to occupying 80% of the deforested area (Jacobi et al., 2019). Other areas equally affected by logging for cattle production are the Gran Chaco in Argentina, Bolivia, and Paraguay, and the arid and semi-arid territories of Argentina and Chile (ECLAC et al., 2017).

However, the region has made progress in the implementation of sustainable technologies and practices. An example of this is the results obtained in pastoral systems in southern Brazil, where it was possible to reduce GHG emissions and increase production through practices such as improving forage quality, the use of vegetables to replace nitrogen fertilization, and rotational grazing (Dick et al., 2015). A study by Rao et al. (2015) shows how in tropical countries improved leguminous and grass forages contribute to the sustainable intensification of mixed production systems. This is because forages accumulate carbon in the soil and reduce emissions, in addition to restoring degraded lands and strengthening systems' resistance to drought. The adoption of silvopastoral and agroforestry systems in countries such as Colombia (Sotelo et al., 2017; Muñoz et al., 2018; Aynekulu et al., 2020), Argentina (Baldassini and Paruelo, 2020), Uruguay (Fedrigo et al., 2018), and Mexico (García et al., 2019), among others, also stands out. Thus, the countries in LAC are gradually achieving the benefits of these technologies, such as biodiversity conservation, soil and water source protection, and landscape beautification, among others (Parra et al., 2019). Sustainability labels for cattle farming have been developed in this context in response to the need to respond to the environmental demands of citizens, but at the same time with the aim of strengthening a fundamental sector for the generation of employment, food security, and the economy in the region.

## 3.2. Overview of sustainability labels

For several decades, LAC counts with different quality labels for beef, among these the most important are *Carne Angus Certificada* in Argentina and *Orgánico Sagarpa Mexico*. The first was developed in 1994 by the Argentine Angus Association and aims to guarantee the racial qualification of origin, in addition to qualities such as flavor and tenderness related to that breed (Sitio Argentino de Producción Animal, 2014). The second, which has been implemented since 2010 by the Secretariat of Agriculture, Cattle, Rural Development, Fisheries and Food (Sagarpa), includes not only beef but also chicken, fruits, vegetables, insects, and others (GIZ, 2017). The label guarantees that the food was produced according to the guidelines of the Organic Products Law, which, in the case of beef implies lower levels of cholesterol and intramuscular fat (López, 2019). As indicated by Morales (personal communication, September 7, 2021)[1], in recent years labels have emerged in the region that go beyond the intrinsic qualities of the product, focusing on sustainability and targeting consumers with differentiated demands regarding environmental issues, generally in markets such as the United States, Europe, and Asia.

Sustainability labels exist in multiple forms based on differences such as the time of development, the objective, the promoting organization, or the type of certification (Figure 2). In relation to the first, consolidated labels stand out, such as *Carne del Pastizal*, which has been promoted since 2010 by the *Alianza del Pastizal*, an initiative promoted by BirdLife International that seeks to protect the grasslands of the southern cone of South America and involves *Aves Argentinas*, SAVE Brazil, *Guyra Paraguay*, and *Aves Uruguay* (Miñarro and Marino, 2013). According to Marino et al. (2013), the scheme was devised with the objective of creating added value to meat products and differentiation in the market in relation to the conservation of grasslands, biodiversity, and nature. On the other hand, in 2012, *Empresa Brasileira de Pesquisa Agropecuária* (Embrapa) conceived the idea of creating a label that would contribute to environmental issues and would be attractive to consumers (Villa et al., 2018). A label was then designed that

1 In quotations from interviewees, last names have been replaced for confidentiality reasons.

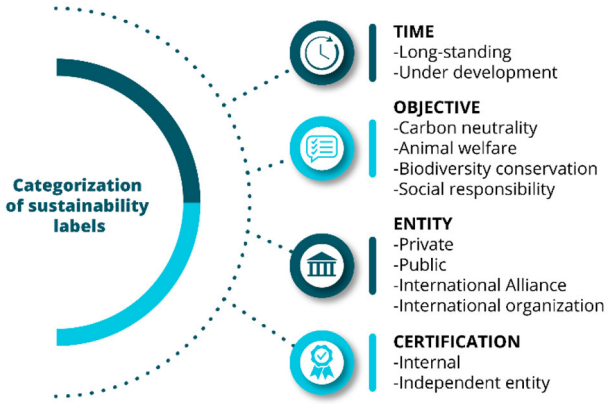


FIGURE 2
Categorization of sustainability labels.

aims at certifying beef produced in silvopastoral and agroforestry systems, contributing thus to the neutralization of GHG emissions (Furlan et al., 2020). According to Villa et al. (2018), the label was registered with the National Institute of Industrial Property (INPI) in two versions, one in Portuguese (*Carne Carbono Neutro*) and another in English (Carbon Neutral Brazilian Beef), which are used for sales in the domestic market and exports, respectively.

In addition to the aforementioned labels, a broader look at other initiatives reveals schemes with different purposes (Table 3). In this regard, it is worth mentioning the Never Ever 3 label, which is promoted by the National Meat Institute of Uruguay (INAC) as part of the Certified Natural Meat Program (PCNCU). The PCNCU is a differentiation scheme for beef products started in 2001 in response to the demands of global markets for animal welfare and environmental protection (INAC, 2018). The Never Ever 3 label, developed since 2014, not only meets the requirements of the PCNCU, but also certifies that cattle have never received antibiotics, hormones, or animal protein (Pérez, 2015). Another label in that regard is Certified Humane which also has an animal welfare objective. It is being promoted in the United States since 1998 by Humane Farm Animal Care and in Latin America since 2008 through the Certified Humane Institute. Its objective is to guarantee that foods such as beef were produced respecting animal welfare from birth to slaughter (Certified Humane Latino, 2021a). The companies certified so far are *Florestal Agropecuária LAR Ltda.* (Brazil), CaraPreta (Brazil), and Ingleby Farms (Uruguay) (Certified Humane Latino, 2021b).

In addition to these long-established labels, there are other more recent ones and some in the development phase (Figure 3). One of these is *Carne Carbono Neutral*, promoted since 2021 in Uruguay by the beef plant Breeders and Packers in association with the forestry company *Montes del Plata*. This certification is initially aimed at 200 producers, but it is expected to be extended to interested farmers who implement forestry systems (Montes del Plata, 2021a). The *Asociación Grass Fed* is currently promoting the Grass Fed label in Argentina. As López (personal communication, September 10, 2021) explains, the label was initially about quality, but in a second stage it will offer sustainability guarantees, too. To this end, measurements will be taken for indicators such as carbon and nitrogen and inspections that will be carried out by LIAF Control. Colombia is a case of interest for the region because of the diversity of sustainability labeling initiatives underway, including the *Sello de Ganadería Sostenible*, *Aval Ganso*, Colombian Beef Grass-Fed CO, and *Sello Ambiental Colombiano*.

Regarding this wide array of labels, several aspects should be highlighted. First, academic literature for LAC shows an increase in beef production based on adaptation and mitigation models, mainly in silvopastoral systems (Murgueitio et al., 2015). However, the development of sustainability labels has been presented in parallel with quality labels. Instead of a transition from one label to another, a scenario is configured in which sustainability is an added value, but not necessarily a priority. This situation is evident in the durability of labels such as *Carne Angus Certificada*, which has not been transformed in search of an environmental approach. Another aspect to highlight is the position of Mexico and Argentina. Despite occupying a leading role in the production and export of beef globally, neither have a sustainability label with a long tradition. In Mexico, labels such as the *Orgánico Sagarpa* can be identified, but with very broad food coverage and without emphasis on the type of product. Although Argentina has the *Carne del Pastizal* label, it is the result of an international alliance and is not specific to the country, while the Grass Fed label is still an initiative under development, with many elements yet to be defined, such as certifying organizations, requirements, and costs. In Central America, there are still many weaknesses in sustainable production itself, which has affected the development of this type of labels, and it is necessary to strengthen the links between researchers, technicians, producers, and other actors in the sector (Murgueitio et al., 2015).

Finally, it is worth mentioning the objectives of the labels. One of the most common, is carbon neutrality, used in Carbon Neutral Brazilian Beef, in Brazil, and *Carne Carbono Neutro*, still under development in Uruguay. Animal welfare is another popular purpose, pursued with the Never Ever 3 and Certified Humane labels. In contrast, criteria such as fair payment to the producer, optimal working conditions, and human and children's rights, do not figure prominently in the identified labels, except in Brazil's *Angus Sustentabilidad* label, where the Brazilian Angus Association guarantees a social responsibility component. This does not mean that the organizations promoting the labels are unaware of such aspects or ignore them in their production processes, but that they are subordinated to the other purposes.

## 3.3. Brazil and Uruguay, regional benchmarks

As outlined above, a variety of sustainability labels exist in Brazil and Uruguay, which makes it relevant to examine some of the characteristics of their certification processes. One of the notable labels is Certified Humane, which is a scheme shared by both countries. According to García (personal communication, September 3, 2021), producers interested in this label must go through a series of stages that range from the implementation of animal welfare standards to the granting or rejection of the

TABLE 3 Characteristics of sustainability labels in LAC.

| Name | Organization | Type of organization | Certifying body | Label Guarantees | Companies and producers certified | Sources |
|---|---|---|---|---|---|---|
| **Argentina** | | | | | | |
| **Grass Fed**  | *Asociación Grass Fed* | Private | LIAF Control | Cattle feeding on pasture (rational voisin grazing, rotational grazing) | 25 cattle farms | Lopez (personal communication Sep 10, 2021) |
| **Bolivia** | | | | | | |
| **Bolivian Natural Beef**  | Federation of Santa Cruz Cattle Farmers (Fegasacruz). Government of Bolivia | Private and public sector | Fegasacruz | Free cattle grazing on pastures | No certified companies or producers yet | Fegasacruz, 2017 |
| **Brazil** | | | | | | |
| **Carbon Neutral Brazilian Beef; *Carne Carbono Neutro***  | Brazilian Agricultural Research Corporation (Embrapa) | State | Public or private agencies at the municipal, federal or state level | Beef production from silvopastoral and agroforestry systems, ensuring the neutralization of GHG emissions | Marfig | Castillo (personal communication, Aug 28, 2021) (Villa et al., 2018; Furlan et al., 2020). |
| ***Angus Sustentabilidad***  | Brazilian Angus Association | Private | *TÜV Rheinland* | Good practices in sustainability, traceability, social responsibility, health, animal welfare, and biosecurity in the production of Angus cattle. | CaraPreta | Associação Brasilera de Angus, 2021 |
| **Uruguay** | | | | | | |
| **Never Ever 3**  | National Meat Institute of Uruguay (INAC) | State | Organizations endorsed by INAC (Latu Sistemas, SGS Uruguay and Certicarnes). | Use of antibiotics, hormones, or animal protein prohibited in cattle throughout their lives. | 85 cattle farms | Fernández (personal communication, Sep 3, 2021) (Pérez, 2015; INAC, 2018, 2021). |

*(Continued)*





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TABLE 3 (Continued)

| Name | Organization | Type of organization | Certifying body | Label Guarantees | Companies and producers certified | Sources |
|---|---|---|---|---|---|---|
| **Carbon Neutral Meat**<br>Being developed | *Montes del Plata* and Breeders and Packers Uruguay | Private | Independent Organizations (Deloitte, Control Union) | Carbon neutrality from forestry plantations | No certified companies or producers yet | Montes del Plata, 2020, 2021a,b |
| International | | | | | | |
| **Certified Humane** | Ingleby Farms (Uruguay) and Florestal Agropecuária LAR Ltda. (Brazil) | International Organization | Certified Humane Latino | Cattle welfare from birth to slaughter | CaraPreta (Brazil)<br>*Florestal Agropecuária* (Brazil)<br>Ingleby Farms (Uruguay) | García (personal communication, Sep 3, 2021) (Certified Humane Latino, 2021a,b) |
| ***Carne del Pastizal*** | *Alianza del Pastizal* | Regional Initiative | *Carne del Pastizal Ltda.* | Grassland, biodiversity, and nature conservation | 180 cattle farms | Mosquera (personal communication, Sep 5, 2021) (Marino et al., 2013) |



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FIGURE 3
Historical development of sustainability labels in Latin America.

certification (Table 4). He adds that slaughterhouses endorsed by the label need to consider the Animal Handling Recommendations Guide (known as the NAMI Guide), published by the North American Meat Institute (NAMI). These guidelines are applied in a similar way in Uruguay and Brazil since they are focused on the species and not on the geographic context. As another of the label's features, García highlights the work with closed herds, which implies that animal welfare is guaranteed at each stage in the production system. Producers, by receiving the certification, are expected to understand two of its main contributions: firstly, the existence of a strong demand for animal welfare and, secondly, the relationship between animal welfare and product quality, both fundamental aspects in gaining access to markets (Munilla et al., 2019).

*Carne del Pastizal* is another initiative involving Brazil and Uruguay. Marino et al. (2013) explain that the development of the label was carried out in several phases, starting in 2010 with the registration of the *Alianza del Pastizal* logo and the *Carne del Pastizal* label with the National Institute of Industrial Property (INPI). The same authors add that a protocol was designed for beef production. It considers the regulations in force in both countries and the participation of technicians and producers, while defining licensing for the use of the label, as well as the forms and the checklist, according to the requirements of the protocol. Carrasquilla (personal communication, September 17, 2021) comments that the certification was designed in a simple way so that it could be widely applied in both countries. The label is particularly important in Uruguay, as grasslands are the country's main ecosystem, which is threatened by eucalyptus afforestation efforts (Brazeiro et al., 2018).

Despite sharing these two labels, there are, however, also differences between both the certifying entities and the two countries regarding other labels. Although *Florestal Agropecuária* includes an animal welfare certification, it only applies to live cattle, therefore, the final product (beef) cannot be sold with the *Florestal Agropecuária* label, which contrasts with the CaraPreta label where both live cattle and end-product are certified (García, personal communication, September 3, 2021). Similarly, Carrasquilla (personal communication, September 17, 2021) states

TABLE 4 Stages of the certification process.

| Label | Stages |
|---|---|
| Certified humane | 1) Request by producer to obtain the label.<br>2) Implementation of good animal welfare practices.<br>3) Inspection by the certifying organization.<br>4) Approval or rejection of the use of the label (Certified Humane Latino, 2021c). |
| *Carne del Pastizal* | 1) Request by producer to obtain the label.<br>2) Inspection of facilities.<br>3) Issue or rejection of certification (Carrasquilla, personal communication, September 17, 2021). |
| Carbon neutral brazilian beef; *Carne Carbono Neutro* | 1) Commitment to adopt a silvopastoral or agroforestry system.<br>2) Technical assessment of carbon emissions.<br>3) Fixed carbon calculation.<br>4) Calculation of emission neutralization.<br>5) Carbon stock guarantee.<br>6) Authorization or rejection of the use of the label (Villa et al., 2015). |
| Never ever 3 | 1) Selection of the certifying organization.<br>2) Completion of membership forms and application for certification.<br>4) Inspection by the certifying organization.<br>5) Issue or rejection of certification (INAC, 2018). |
| *Angus Sustentabilidad* | 1) Request by producer to obtain the label.<br>2) Producer training on label requirements.<br>3) Adjustments to the production process.<br>4) Inspection by the certifying organization.<br>5) Approval or rejection for use of the label (Landino, personal communication, September 22, 2021). |
| *Carne Carbono Neutral* | There is still no certification process (Muñoz, personal communication, September 2, 2021). |

that Uruguay is the only country that exports beef with the *Carne del Pastizal* label, while Brazil, Argentina, and Paraguay entirely use it for their domestic markets. He also points out that Brazil still has deforestation problems, which makes exporting beef with such label complex. This coincides with a study by Kohler et al. (2021), who report that cattle farming was the major cause of deforestation in the Brazilian Amazon biome (north of *Mato Grosso*) between 1985 and 2020, with worrying cases such as *Nova Bandeirantes*, where 812.52 $km^2$ of rainforest was deforested between 2008 and 2020.

In Brazil, Embrapa has implemented the Carbon Neutral Brazilian Beef and *Carne Carbono Neutro* labels, which are exclusively used by the *Marfrig* company (Castillo, personal communication, August 28, 2021). As explained by Villa et al. (2018), the labels currently focus on the neutralization of enteric methane emissions from grazing cattle, but it is expected that other emissions along the production chain will be included. These authors explain how both methane measurement and neutralization are carried out. First, equations based on predetermined indexes are used, and secondly, the carbon accumulated in the trees (specifically in the trunk), is quantified. This figure is then used to carry out a forest inventory of the area. The labels are extremely important in the national context, because in 2019 emissions from the agricultural sector reached 598.7 million tons of $CO_2$eq., with enteric fermentation responsible for 61.1% of this figure, as revealed by the Observatório do Clima (2020).

On the other hand, with a similar objective, the Uruguayan meat packing plant BPU Meat–in association with the forestry company *Montes del Plata*, is currently developing a carbon neutral beef label. The certification will be audited based on international protocols (Montes del Plata, 2021a). However, as Muñoz (personal communication, September 2, 2021) highlights, the process is in a very early stage, and costs and requirements have not yet been established. The purpose of the label is to guarantee the consumers that cattle are held in production systems that capture carbon. In this regard, Morales (personal communication, September 7, 2021) comments that the production cut-off point used for certification has not yet been decided, i.e., it could be limited to the farm or may include logistic, industrial, or transport stages. He also points out that the relationship between cattle and forestry guaranteed by the label takes two forms. The first, because the producers take their cattle to graze in purely forestry lands. The second, because they incorporate forestry as a way of diversifying their production. Such advances coincide with the research of Fedrigo et al. (2018), which posits that silvopastoral systems in Uruguay consist of high-density plantations that produce pulp or lumber for sawmilling, highlighting that this type of mixed production system aims at strengthening positive (facilitation) and mitigating negative (competition) interactions. Finally, Muñoz (personal communication, September 2, 2021) states that one of the label's aims is to function as a laboratory, so that it can be expanded to the national level with the mediation of organizations such as INAC.

From another perspective, but also in Uruguay, there is the Never Ever 3 label. According to the label protocol, producers must guarantee to not use antibiotics in animals both in subtherapeutic levels and in therapeutic doses of sulfonamides and ionophores, while eliminating the use of growth-promoting hormones (natural or synthetic) and by-products of mammalian and poultry origin in animal feed. If cattle require the use of antibiotics due to disease they should be eliminated from the program (INAC, 2016). In relation to the above, Fajardo et al. (2011) mention that residues of these types of substances can be retained in beef and affect the health of consumers, an aspect that the importance of the label highlights. Fernández (personal communication, September 3, 2021) comments that certification is carried out by independent organizations, but approval or rejection for the use of the label ultimately depends on INAC.

Once again in Brazil, the *Angus Sustentabilidad* label stands out. Among its six pillars, three aspects are be emphasized: environmental sustainability, animal welfare, and social responsibility. Regarding the first, the label guarantees the preservation of vegetation in springs, a percentage of natural reserve areas, and recovery plans for degraded areas (Associação Brasilera de Angus, 2021). The second component considers criteria such as separation of healthy and sick animals, adequate space for each animal, and access to water and quality feed. The third component includes the prohibition of child labor and excessive working hours, as well as employees' access to protective equipment, training in the use of machinery, and ensuring that their children attend school. Landino (personal communication, September 22, 2021) points out that the label is still restricted to the domestic market, but that there is interest from external buyers.

The above elements allow us to draw some conclusions. Firstly, both scenarios show the opening of national and international markets, one of the objectives of the sustainability labels. Thus, for example, the *Carne del Pastizal*, Certified Humane, and Never Ever 3 labels facilitate export to customers in Europe and China (Carrasquilla, personal communication, September 17, 2021; Fernández, personal communication, September 3, 2021; García, personal communication, September 3, 2021), while the Carbon Neutral Brazilian Beef and *Angus Sustentabilidad* labels have strengthened the national demand (Castillo, personal communication, August 28, 2021; Landino, personal communication, September 22, 2021). Such experiences are not only successful in themselves but should be taken as references for other producers in the region, since access to markets can also translate into higher sales volumes and price premiums and, consequently, economic growth for the producers, the associated value chains, and the sector.

Another relevant aspect is the reliability of the certifying institutions. A certification by internationally recognized bodies such as *TÜV Rheinland*, Deloitte, and Certified Humane, guarantees that the labels really meet the promised objective. Therefore, the labels are not only displayed for the benefit of companies, but also for consumers and the cattle sector itself, in the pursuit of sustainable intensification. Such rigorous audits are not a barrier to certification. On the contrary, despite the differences between the processes, they are relatively similar. They are characterized by their flexibility and the opportunity to make necessary adjustments in cattle production to obtain the certificate (Figure 4).

Finally, it should be noted that although Brazil and Uruguay are regional references in the development of beef sustainability labeling, their contexts are clearly diverse. For Brazil, Landino

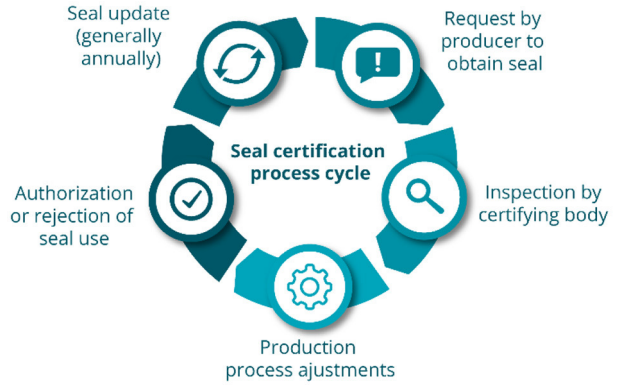


FIGURE 4
Label certification process cycle.

(personal communication, September 22, 2021) comments that due to the size of the country, different cattle production approaches are used. In the south (border with Uruguay), pasture-raised cattle stand out, but in the center, the feedlot system still prevails. The latter is understood in negative terms, as such systems generate large amounts of manure and urine that can contaminate soils, and surface and deep waters, among other environmental effects (Míguez et al., 2019). In contrast, Uruguay is characterized by native pastures (Morales, personal communication, September 7, 2021). In addition, there are other production system characteristics, such as the use of computer platforms and a sophisticated and consolidated traceability system that can be used in the future for issues such as carbon measurement (Muñoz, personal communication, September 2, 2021). Consequently, Uruguay has ideal conditions for sustainable cattle production, which accounts for its leadership in the development of such labels.

## 3.4. Sustainability labels in Colombia

Since 2020, a set of sustainability labeling initiatives for beef with different objectives have been emerging in Colombia (Table 5). Among these, the *Aval Ganso* label stands out, with certified products available in supermarkets in Bogotá, Medellín, and Villavicencio (Álvarez, personal communication, September 10, 2021). This label has four pillars that cover 50 cattle production practices: (1) Environment, which considers the reduction of GHG emissions and the protection of biodiversity and ecosystems. (2) People, which guarantees decent and fair working conditions for employees and healthy environments for them and their families. (3) Animals, which ensures that cattle are healthy and properly fed, held, and treated. (4) Management, which consists of planning, auditing, and improving the above aspects, while striving for business profitability (Ganso, 2021). As explained by Alvarez (personal communication, September 10, 2021), the certification process begins with the producer's request to obtain the label, followed by an audit by an independent body (Table 6). In the process, each of the items is verified and the level of the label to be awarded is determined according to the percentage of compliance. *Motivated* means a compliance of <50%, *Committed* between 51% and 80%, and *Responsible* >81%. The label aims at going beyond other initiatives, as it not only considers the detriments of traditional cattle farming, such as deforestation (Armenteras and Rodríguez, 2014), biodiversity loss (Marques et al., 2019), GHG emissions (Molina et al., 2019), among others, but, as academic readings point out, also includes animal welfare as a new challenge in cattle production (Muñoz, 2014), and the role of people as an axis of sustainability (Tedeschi et al., 2015).

On the other hand, Parra et al. (2019) state that to achieve sustainable intensification of cattle farming, one of the alternatives is to promote the use of endemic and introduced trees and shrubs as cattle feed. This approach is in line with the Colombian Beef Grass-Fed CO label, which guarantees pasture feeding in forestry systems, thus contributing to the reduction of GHG emissions and the protection of the natural environment and biodiversity (Cifuentes, personal communication, September 29, 2021). One of the main achievements of the process has been the opening of the Chilean market, to which 312 tons of beef were exported in 2020 worth US$1.5 million (Fedegán, 2020). The *Sello de Ganadería Sostenible* label also stands out for its sustainable approach to pasture management. As stated by Romero (personal communication, September 14, 2021), the certification considers four pillars, namely (1) an integrated cattle management system which respects the ecosystems in vulnerable areas; (2) sustainable pasture and grazing land management; (3) animal welfare; and (4) fair treatment of workers. The label is currently limited to the domestic market, but new national and foreign customers are being sought.

Another initiative is the *Sello Ambiental Ganadero* label, which is currently being developed based on the Colombian Technical Standard 6550:2021 from the Colombian Institute of Technical Standards and Certification (ICONTEC). The draft document sets out four principles, namely (1) Environmental responsibility, which focuses on the conservation of forests and other ecosystems, the preservation of biodiversity, and the promotion of reforestation plans; (2) best practices in cattle production in harmony with the environment for guaranteeing the use of organic waste, efficient water management, the correct use of hazardous waste, and soil protection; (3) good cattle husbandry practices, which consider individual animal identification, vaccination plans, proper use of agricultural inputs, and animal welfare; and (4) responsibility for employees, which include biosecurity measures, with fairness, and respect (ICONTEC, 2021).

In view of the above, the first aspect to highlight is the COVID-19 situation, which coincided with the emergence of the labels in question (years 2020–2021). According to several studies (e.g., Burkart et al., 2020, 2022; Ramírez et al., 2021), this generated difficulties in the import and export of food and agricultural inputs, while reducing demand due to factors such as lower economic capacity and even fear of contagion on the part of consumers. As Bisoffi et al. (2021) highlight, the pandemic affected both rich and developing countries, and high and low strata. Mejía et al. (2021), on the other hand, comment that the outbreak in Colombia does not even compare with other countries regionally, since unemployment, poverty, and low quality of life generated

TABLE 5 Characteristics of Colombian sustainability labels.

| Name | Organization | Type of Organization | Certifying body | Label guarantees | Companies and producers certified | Sources |
|---|---|---|---|---|---|---|
| *Aval Ganso* | Climate Focus; Alliance of Bioversity International and CIAT; *Grupo Éxito* | Intermediary advisory organization; Center for Research | Ganso | Four pillars:<br>Environment<br>People<br>Animals<br>Management. | *Grupo Éxito* | Ganso (2021) |
| Colombian Beef Grass-Fed CO | *Fedegán-FEP; ProColombia* | Trade organization; Government agency | *Fedegán-FEP* | Natural production and pasture-based feeding for animals | Athena Foods; *Angus Azul*; *Frigosinú*; *Friogan* | Cifuentes (personal communication, Sep 29, 2021) |
| *Sello de Ganadería Sostenible* | Angus and Brangus Association | Private | Angus and Brangus Association | Ecosystem conservation, carbon footprint reduction, animal welfare, social responsibility | No certified companies or producers yet | Romero (personal communication, Sep 14, 2021) |
| *Sello Ambiental Ganadero.* Under development | *Fedegán* | Trade organization | Independent institution accredited by the National Accreditation Body of Colombia (ONAC). | Environmental responsibility. Cattle production practices in harmony with the environment. Good cattle practices. Responsibility for employees | 12 cattle farms | Prado (personal communication, Sep 27, 2021) (ICONTEC, 2021) |



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immediate negative impacts. However, it is evident that the labels described have fulfilled the commercial purpose of opening markets (mainly domestic), revealing their ability to resist such crises.

Likewise, one of the challenges to be overcome by the different initiatives is related to the certification processes, since no international organizations have been involved that could provide consumers with greater confidence. Likewise, the breadth of guarantees offered by the labels are ambivalent. On the one hand, they are comprehensive, including environmental indicators, animal welfare, social responsibility, among others. On the other hand, their lack of focus could result in a superficial treatment of all these items listed. In view of the above, it is evident that the labeling strategies discussed are still relatively new. However, they are gradually beginning to consolidate and are likely to have an impact in the future in terms of sustainability and the opening of new domestic and foreign markets.

## 3.5. Lessons learned from the implementation of the labels

The development of sustainable labeling in LAC presents a set of difficulties and successes at each stage. According to Landino (personal communication, September 22, 2021), one of the main challenges is the incorporation of producers into the initiatives, since they believe that large investments are required, such as for the purchase of seeds or trees for afforestation purposes, a conditioning of facilities for animal welfare, and the implementation of carbon monitoring, reporting, and verification platforms, among others. Fernández (personal communication, September 3, 2021), emphasizes that such schemes are voluntary, so great perseverance is required. These statements coincide with Gómez del Campo (2015), who emphasizes the need to invest in education and training to stimulate sustainable cattle farming and participation in certification schemes.

Likewise, the production stage also involves some difficulties. As Morales (personal communication, September 7, 2021) points out, factors such as climate or the growth cycle of pastures can affect the production of a steady number of certified animals. A too high demand can thus challenge the production systems. Garcia (personal communication, September 3, 2021) mentions traceability as another challenge, since it is complex to track cattle along the different facilities from birth to slaughter. In the particular case of Certified Humane, he highlights the dependence between farms and slaughterhouses, as each of these parties must ensure that the other complies with the standards of the label in order to obtain the certification. In this regard, traceability systems have recently been tested on cattle based on electronic identification and DNA (Pofcher, 2017), which could contribute to resolving this issue. On the other hand, Carrasquilla (personal communication, September 17, 2021) mentions that the main challenge in the marketing stage is low demand for the certified product, which contrasts with what is stated by Morales. Additionally, many producers decide to abandon the initiatives when they do not receive the expected economic benefits. Moreover, Carrasquilla adds that although these types of labels have provided an opening of certain markets, this does not happen in contexts where environmental concerns are perceived less relevant.

TABLE 6 Stages of the Colombian certification process.

| Label | Stages |
|---|---|
| *Aval Ganso* | 1) The producer expresses their intention to obtain the label.<br>2) The audit is carried out by an independent organization.<br>3) The audit report is sent to Ganso, which sends the results to the producer.<br>4.1) If the evaluation is positive, certification is granted for a period of two years.<br>4.2) If the evaluation is negative, a re-evaluation is carried out to adjust the indicators not met by the producer (Ganso, 2021). |
| Colombian beef. Grass-fed CO | 1) Submit a written application to the FEP Technical Secretariat expressing interest in using the label.<br>2) Audit by FEP.<br>3) Acceptance or rejection of the submitted application. (Cifuentes, personal communication, September 29, 2021). |
| *Sello de Ganadería Sostenible* | 1) Asobrangus sends the offer to members for certification with the label.<br>2) Evaluation of aspects to be improved by the producer.<br>3) Second visit to evaluate progress.<br>4) The evaluation committee awards a score to the producer.<br>5) The use of the label is authorized (granted for two years) or declined (Romero, personal communication, September 14, 2021). |
| *Sello Ambiental Ganadero* | Under development. |

Despite the issues mentioned above, there are also multiple successes. Muñoz (personal communication, September 2, 2021) states that the opportunities related to e.g., higher sales numbers, price premiums, and income generation currently outweigh the limitations related to e.g., required investments and lack of producer trainings, mainly when the demands for entry into markets such as the United States, Europe, and Asia are considered. García (personal communication, September 3, 2021) agrees in this regard, highlighting the success of certified products over non-certified ones. Likewise, it is also worth highlighting that there exist producers who implement sustainable production methods although they may not financially benefit from it (Carrasquilla, personal communication, September 17, 2021).

The discussion above reveals a complex landscape. On the one hand, obstacles related to producers have been identified, such as their reluctance to join or remain in sustainable labeling initiatives. Among the specific challenges one can find the evaluation of factors such as carbon balance, reforestation, animal welfare, and social responsibility, among others, which require rigorous technical follow-up, as well as the difficulty for smallholder producers to implement electronic traceability systems, since they represent high costs. It is precisely this technical and economic complexity that explains the rejection by many producers of the certification processes, especially if the efforts are considered that are not necessarily reflected in financial terms. In this sense, it is essential to foster the exchange of successful experiences to encourage more

producers to implement sustainability strategies and participate in certification processes, in addition to greater support from national governments in terms of monetary incentives and technical assistance, either from the implementation of public policies, legislative advances, or other types of institutional actions. Finally, the circumstances of the COVID-19 pandemic should be taken into consideration, since its effects in terms of prices, consumption, and other relevant factors are likely to continue to affect the performance of the beef value chain, to such an extent that they will reformulate the sector (Burkart et al., 2020).

## 4. Recommendations

The main recommendation is the need for a more active role of state institutions in the development of sustainability labeling in each of the countries. Policymakers and national governments must understand the contributions of this type of initiatives and include them in their legislation and public policies. It is also essential to establish channels of dialogue with and among cattle producers and thus generate feedback that will make it possible to identify common successes and difficulties, achieving increasingly more comprehensive certification processes. It is also necessary for the involved companies to distribute the price premium along the value chains, as this value sometimes does not reach the primary link, which is discouraging producers from joining the strategies. In the cases of Mexico and Argentina, it is necessary to make progress in implementing sustainability labels, otherwise they will fall behind their competitors, a situation that also applies to the Central American and Caribbean countries. In Colombia, on the other hand, it is essential to pursue the involvement of international organizations in certification processes and monitoring, since it will provide greater guarantees to consumers.

## 5. Conclusions

Although the conditions in LAC are favorable for the development of sustainable beef labeling, progress to date has not been significant. Firstly, the development of the initiatives is uneven, with lags in Central America and the Caribbean being particularly noticeable. Even countries with a long cattle farming tradition, such as Brazil, Uruguay, Argentina, and Mexico, show differences between them. While Brazil and Uruguay have promoted labels of this type, the others persist with traditional production methods, since the quality criteria currently in place are still sufficient to maintain many markets. In this sense, Colombia is noteworthy, because producers have understood that sustainability is gradually acquiring greater value and is an opportunity to position their products nationally and abroad. Another regional characteristic of the labels is the absence of a triggering or coordinating factor, as can be seen in the way that initiatives have begun spontaneously and gradually in different contexts but lack an institution or other mechanism to facilitate feedback.

Among the positive aspects, countries such as Uruguay and Brazil demonstrate joint efforts between state institutions and private organizations, in addition to the participation of independent oversight bodies. This is fundamental, as it offers greater guarantees regarding the certification process, as well as promoting the search for good governance. However, in these countries, as well as Colombia and Argentina, exclusive private labeling strategies continue, which is detrimental to the reliability certification can offer. Likewise, there is a diversity of labels in the market, which fails to offer consumers guarantees and makes it difficult for them to differentiate between those that do or do not have rigorous certification.

It should be noted that the future of labels in LAC is highly uncertain, not only because of the aforementioned difficulties and complexities, but above all because of external factors. The most significant of these factors is the COVID-19 pandemic, which has affected people's purchasing power and, consequently, their consumption patterns, a situation that will not improve in the short or medium term. This likely means that as long as the labels imply a higher price, regional demand will be minimal and the success of the labeled products is limited to niche markets abroad. On the other hand, although this research is exposed as an input for the development of future labels, it is not possible to formulate standard criteria that ensure their success or the quality of a certified product, since this depends on the dynamics of each process that derive from of its context, objective, and involved entities, among others.

To conclude, it is important to bear in mind that the labels addressed are only one among many other strategies aimed at sustainable intensification. Therefore, they must be understood in a broader context, alongside public policies, legislation, and national and local initiatives. It is also essential to reiterate that, despite the difficulties, the transition to sustainable cattle farming is inevitable. The demands of consumers and markets as well as public policies are forcing producers to make this change in the medium and long term. However, the transition will not occur spontaneously, since (as has been pointed out) traditional cattle farming continues to be profitable. It is on this premise that a variety of actors, such as governments, policymakers, and NGOs, among others, must intervene to create the appropriate conditions for this process.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

This research was reviewed and approved by the Institutional Review Board of the Alliance of Bioversity International and CIAT to assure compliance with institutional policies and publication ethics. All study participants signed an informed consent prior to data collection.

## Author contributions

LL, MD, and SB: conceptualization, methodology, writing the original draft, review and editing, resources, and supervision. LL

and MD: formal analysis. MD and SB: supervision. SB: funding acquisition and project administration. All authors contributed to the article, approved the submitted version, and confirmed that the content of the manuscript has not been published or submitted for publication elsewhere.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Annex 1. Key informant interview questions/questionnaire

1. What are the sustainability guarantees offered by the seal (biodiversity protection, zero deforestation, carbon neutrality, social responsibility, etc.)?
2. From what year was the seal implemented, and what products does it cover?
3. What actions has the organization developed to respond to the guarantees offered by the seal? (Reforestation, silvopastoral systems, etc.).
4. What is the certification process like?

   a) What requirements must be met?
   b) What are the stages?
   c) Does the organization certify its products itself, or does a third party do it?
   d) What are the costs?

5. How many producers or companies have been certified so far?
6. What effects have been seen since the seal was implemented? (Opening of new markets, increased sales, etc.).
7. What have been the difficulties and lessons learned in the process of implementing the seal?
8. What are the label's medium- and long-term expectations?
9. Do you know of any other sustainability seals for meat in your country?
10. Do you wish to highlight any other aspect?