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Mapping food businesses with regenerative potential in the Amazon and Central American Dry Corridor

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The global food system plays a pivotal role in environmental challenges, being a major contributor to climate change, the primary driver of tropical deforestation, and responsible for one-third of global greenhouse gas emissions. In response to these challenges, a regenerative approach to food businesses has emerged as a promising framework for driving environmental change and addressing the climate crisis. However, there is a gap in information across Latin America regarding the number, location, and activities of food businesses adopting a regenerative approach, hindering a better understanding of this trend and limiting its potential support in the region. This article presents the results of a mapping effort using specific criteria and analytical frameworks to build a better understanding of how regenerative food business models are evolving in Latin America. The mapping was conducted across six countries in the Central American Dry Corridor and five in the Amazon Biome. The process involved using the Google search engine with 77 keyword combinations, complemented by information from 50 key informant interviews. A total of 181 businesses with a potentially regenerative focus were identified. Of these, 64 were explicitly using the term "regenerative," with its usage being more prevalent in the Central American Dry Corridor than in the Amazon. Notably, businesses using the term were non-associative enterprises. In contrast, associative enterprises such as cooperatives and associations, although not employing the term "regenerative," played a critical role in socio-cultural and environmental conservation of territories, particularly when led by indigenous or other local traditional populations. Furthermore, the participation of women in leading these businesses was higher than in other traditional businesses, though it still reflected global gender imbalances in leadership positions compared to men. This study provides one of the first comprehensive mappings of regenerative food businesses in the Amazon and CADC, offering valuable data from Latin America. The findings reveal the distribution, characteristics, and diverse ways businesses engage with regenerative practices, underscoring the need for further research beyond the explicit "regenerative" term to fully capture the scope of initiatives driving socio-environmental transformation in the region.

KEYWORDS

regenerative food business, sustainable business models, regenerative agriculture, sustainable food systems, regenerative transition, food business mapping

1 Introduction

The global food system significantly contributes to climate change (Mirzabaev et al., 2023), serving as the primary driver of tropical deforestation (Pendrill et al., 2019) and accounting for one-third of all greenhouse gas emissions (Crippa et al., 2021). In Latin America and the Caribbean (LAC), agriculture contributes between 5 and 18% of GDP in at least 20 countries. However, this share increases significantly when considering the broader food system. For example, when accounting for jobs linked to the food industry, the contribution grows substantially, driven by the sector's modernization and the rise of new types of employment (Morris et al., 2020). Nevertheless, the consequences of the dominant production model, often deemed unsustainable, directly affect the sector itself. The environmental impact of the food system in Latin America undermines the quality and availability of natural resources, which in turn exacerbates the region's socioeconomic challenges (Morris et al., 2020; Araújo et al., 2023). Although LAC is globally recognized as a biodiversity hotspot with high endemism in the Neotropics (UNEP-WCMC, 2016), it also has the highest levels of land inequality worldwide (von Bennewitz, 2017). The region faces negative balances in the natural regeneration of agricultural landscapes, which are often fragile ecosystems (Chazdon et al., 2020). Furthermore, human poverty persists in rural areas despite ongoing efforts to alleviate it (ECLAC, 2024).

In response to the structural challenges associated with food production, the regenerative approach, being applied to agriculture, business, and food systems, has gained attention as a promising framework for driving positive environmental change and addressing the climate crisis as part of efforts to transform food systems (Lal, 2020; Loring, 2022; Montgomery et al., 2022; Schulte et al., 2022; Buckton et al., 2023; Nabuurs et al., 2023; Jayasinghe et al., 2023; Khangura et al., 2023). This approach proposes a significant shift away from extractivist systems, promoting sustainability through practices that enhance ecosystem health, foster resilience, and support long-term productivity (Schreefel et al., 2020; Jayasinghe et al., 2023; Khangura et al., 2023). Nonetheless, most efforts to understand "regeneration" have been oriented to the agricultural sector, resulting in a reduced exploration of its broader influence across other stages of food chains.

While the "regeneration" has received growing attention in the context of agriculture, Buckton et al. (2023) highlight the diverse ways a regenerative approach is being integrated into broader food systems, emphasizing transformative socio-ecological changes beyond on-farm primary production and extending its influence on various businesses and structures throughout food value chains. In this context, a regenerative lens not only shares principles and practices with ecologically-based agricultural movements (Newton et al., 2020; Elrick et al., 2022; Gordon et al., 2023) but also with other fields, such as alternative business models, economic and governance frameworks, and other perspectives that challenge dominant food system paradigms (Buckton et al., 2023; Duncan et al., 2020).

Recent studies highlight that regenerative practices particularly soil restoration and agroforestry techniques, are not only effective in mitigating the environmental impacts of extractive agriculture (Elevitch et al., 2018) but also have the potential to improve yields (LaCanne and Lundgren, 2018; Khangura et al., 2023). On the other hand, the regenerative approach has also proven to be a key driver of transformation at the business and food system levels (Buckton et al., 2024), fostering the co-creation of opportunities in collaboration with communities and their local social environment and leading to improved outcomes in income, commercial relationships, gender equity, health, and safety (Fullerton, 2015; Hahn and Tampe, 2021; Vlasov, 2021; Caldera et al., 2022). Additionally, as these businesses strengthen their connection to the environment, they co-evolve with ecosystems, contributing to the preservation and restoration of natural resources (Hahn and Tampe, 2021; Vlasov, 2021). Consequently, as they reverse their negative impacts, they progressively and positively influence the socio-ecological system of other sectors within the value chain (Caldera et al., 2022).

At the same time, it is essential to recognize and value the mindset and practices embedded in the regenerative approach across all these fields, as they are deeply rooted in the traditional knowledge of Indigenous and other native communities (Buckton et al., 2023; Sands et al., 2023). In regions such as the Amazon, where Indigenous communities are key stewards of the land, these practices contribute not only to environmental restoration but also offer context-specific solutions to the socio-environmental challenges faced by these regions (Reyes-García et al., 2019; Meli et al., 2022).

With a broader scope across food systems, a regenerative approach holds the potential to drive significant changes in the socioeconomic and environmental conditions of fragile landscapes across Latin America. For instance, the Central American Dry Corridor (CADC), a region spanning approximately 1.6 million km^2 and home to over 11 million people (Gotlieb et al., 2019), faces critical vulnerability to climate change. Declining rainfall and intensifying drought conditions have severely impacted the area, where more than 70% of the population lives in poverty and depends on subsistence agriculture (Huber et al., 2023). This region has also seen a rise in climate-induced migration, highlighting the urgent need for resilient agricultural systems that can adapt to extreme weather events and strengthen local food sovereignty (Fraga, 2020).

Similarly, the Amazon biome, which covers more than 7 million km^2 and is home to over 50 million people (CEPAL and OTCA, 2024), is facing unprecedented challenges due to deforestation, unsustainable agricultural practices, and extractive industries such as mining and illegal logging. These activities contribute to environmental degradation and disrupt global climate regulation (Ruiz Agudelo et al., 2020). Although the Amazon has more favorable rainfall patterns compared to the CADC, deforestation has led to shifting climate patterns, increasingly exposing the region to drought and extreme temperatures (IPCC, 2014; Zevallos and Lavado-Casimiro, 2022; Bottino et al., 2024). The extreme poverty in the territories of the Amazon biome exceeds 20% compared to non-Amazonian areas in the countries where they are located. Depending on ethnic background and geographic isolation, access to essential services—such as healthcare, education, clean water, and infrastructure—is significantly more limited than in non-Amazonian regions (CEPAL and OTCA, 2024).

While the regenerative approach has garnered significant interest recently, several challenges related to its applicability and promotion remain prominent: (1) To integrate regenerative approaches into decision-making and policy areas, the regenerative approach must better articulate food system chains—not only addressing challenges at the primary production level but also ensuring that products retain their regenerative "identity" as they move through the subsequent stages of the value chain to reach the end consumer (Al-Kaisi and Lal,

2020; O'Donoghue et al., 2022; Tittonell et al., 2022); (2) Insufficient scientific evidence on the contributions of the regenerative approach to food security, climate change adaptation and mitigation, and other benefits at various scales limits effective decision-making and policy formulation (Al-Kaisi and Lal, 2020; McLennon et al., 2021; Tittonell et al., 2022); (3) Despite narratives emphasizing its importance, the social dimension within regenerative approach remains underdeveloped (Gordon et al., 2023; Bless et al., 2023; Wilson et al., 2024); (4) There is a lack of financial services tailored to this businesses model, hindering its scalability. The financial sector often applies restrictive risk assessments based on measurable impact data, which many regenerative businesses struggle to provide under conventional financing expectations (Schulte et al., 2022; Bosma et al., 2022). While the regenerative approach incorporates scientifically proven environmental benefits (Khangura et al., 2023), its limited ability to systematically demonstrate economic returns remains a barrier to securing funding (Grelet et al., 2021). (5) Consumer awareness of regenerative products is low (Beacham et al., 2023); and (6) There is no clear information across Latin America regarding the number, location, and activities of food businesses adopting the regenerative approach, including primary producers, processors, retailers, and other actors operating within this framework. This should go beyond the mere use of the term, focusing as well on businesses that embody this approach at their core, such as Indigenous initiatives and others that operate outside trendy terminologies.

To address existing knowledge gaps and enhance understanding of the adoption and dissemination of regenerative approach among food businesses in the CADC and Amazon regions, we conducted a mapping process. This effort aimed to identify food businesses that incorporate regenerative practices and values. To capture the distribution and development of Regenerative Food Businesses (RFBs) in these two regions, we used the definition of RFBs developed by the RFB Consortium[1] as a guiding reference:

> *"Initiatives that prioritize the centrality of nature within the business approach to food production. In RFB, the conservation, restoration, and strengthening of ecosystems are central to the activities, purposes, and value proposition of the business. At the same time, they are aligned with an integral and holistic approach, aiming to ensure that equity, sociocultural justice, and economic prosperity are distributed throughout the supply chain and processes to which they are connected."* (NAR, 2023).

According to the NAR (2023), the key difference between a business with a regenerative approach and a traditional sustainability model lies in its intentional, continuous commitment to improving and evolving the system in which it operates. Regeneration is an ongoing process, not a fixed endpoint. It goes beyond implementing a set of practices and claiming to be regenerative. A truly regenerative business continuously evolves its practices with a clear, impact-driven vision that emphasizes both ecological and sociocultural systems. Some businesses may not explicitly use the term "regenerative," but still fully embody this holistic and evolving approach, particularly those rooted in Indigenous traditions. To determine if a business genuinely aligns with the regenerative approach, it is essential to understand its history, narrative, evolution, vision, and the practical actions that support these principles.

Considering the above, this study represents a first effort to address questions such as: What food businesses exist in the CADC and Amazon that align with a regenerative approach or are transitioning toward it? What activities do these businesses engage in? What types of products and services do they offer? And do these businesses integrate gender and social equity perspectives into their practices? The answers to these questions provide the foundation for a comprehensive understanding of the RFB ecosystem in the CADC and Amazon. This understanding will help inform more effective efforts to promote and develop these businesses, including the design of public policies, financing mechanisms, targeted capacity-building initiatives, and other related actions.

2 Materials and methods

The methodology for mapping and assessing Regenerative Food Businesses (RFBs) in the CADC and Amazon was designed to identify and characterize food businesses with a potential regenerative approach, while also providing a broader understanding of how these businesses are developing in the two regions. The methods and tools for data collection were implemented in the following stages:

2.1 Scope of the mapping

The scope of the mapping process was determined by three factors: (a) the definition of the geographical area for the survey, (b) the selection of the online search engine, and (c) the keywords and languages used for the online search. The geographical boundaries were set to include the Amazon biome and the CADC region. In the Amazon, the selected countries were Brazil, Peru, Ecuador, Bolivia, and Colombia. For the CADC region, the selected countries included Costa Rica, Honduras, Guatemala, El Salvador, Panama, and Nicaragua. Google Search (hereafter referred to as Google) was used as the online search engine for the mapping process. For each of the 11 selected countries, six keyword combinations were applied to Google in the respective languages: Portuguese for Brazil, Spanish for Spanish-speaking countries, and an additional combination in English for all countries. Additionally, to complement the online search and capture initiatives that might not appear in search results, we conducted semi-structured interviews with key informants—experts and organizational representatives involved in regeneration efforts.

As shown in Table 1, the search prompts (Supplementary material 1), included keywords related to the study's focus, such as "regenerative" or "regeneration," combined with terms associated with food production, such as "agriculture," "livestock," "system," and "businesses," as well as geographical identifiers like

1 The RFB Consortium was born within the framework of the Project Regenerative Food Businesses and investment with a gender lens: regeneration for a better reconstruction of the Amazon and the Central American Dry Corridor of Latin America and the Caribbean, funded by IDRC Canada and coordinated by the AVINA Foundation. Members of the Consortium: IDRC, AVINA Foundation, WTT, CATIE, Sistema B, NESsT, SVX-Mx, SEKN, GRADE, URL. More info: www.regenerativo.org.

TABLE 1 Combination of keywords applied to Google search.

Main term	Keywords combination applied to Google Search	Language
Regenerative agriculture	“agricultura regenerativa” + "amazonia” + "país”	Spanish
Regenerative livestock	“ganadería regenerativa” + "amazonia” + "país”	Spanish
Regenerative businesses or enterprises	“negocio” OR”empresa” + "regenerativo” OR”regenerativa” + "amazonia” + "país”	Spanish
Regenerative food system	“sistema” + "alimentario” OR”alimentar” + "regenerativo” OR”regenerativa” + "amazonia” + "país”	Spanish
Agroecology and regeneration	“agroecología” + "regeneración” OR”regenerar” + "amazonia” + "país”	Spanish
Multiple combinations	“agricultura” OR”negocio” OR”empresa” OR”sistema” + "regenerativo” OR”regenerativa” + "amazonia” + "país”	Spanish

Main term	Keywords combination applied to Google Search	Language
Regenerative agriculture	“agricultura regenerativa” + "amazônia” + "brasil”	Portuguese
Regenerative livestock	“percuária regenerativa” +”“amazônia “+"brasil”	Portuguese
Regenerative Businesses or Enterprises	“negócio” OR”empresa” + "regenerativo” OR”regenerativa” +” amazônia “+"brasil”	Portuguese
Regenerative food system	“sistema” + "alimentar” + "regenerativo” OR”regenerativa” +” amazônia “+"brasil”	Portuguese
Agroecology and regeneration	“agroecologia” + "regeneração” OR”regenerar” +” amazônia “+"brasil”	Portuguese
Multiple combinations	“agricultura” OR”pecuária” OR”negócio” OR”empresa” OR”sistema” + "regenerativo” OR”regenerativa” +” amazônia “+"brasil”	Portuguese

Main term	Keywords combination applied to Google Search	Language
Multiple combinations	“agriculture” OR”livestock” OR”business” OR”company” OR”system” + "regenerative” +” amazon” +"país” -"shop” -"buy” -"medicine” -"therapy”	English
Multiple combinations	“agriculture” OR”livestock” OR”business” OR”company” OR”system” + "regenerative” + "país del CSC” -"shop” -"buy” -"medicine” -"therapy”	English

“Amazon” and “Colombia.” Additional exclusion prompts were applied to filter out irrelevant results often linked to the term “regenerative,” such as those related to “therapy,” “medicine,” or “shop” (frequently leading to the Amazon online store). Moreover, to ensure the most accurate search results, the language and region settings in Google were adjusted for each country.

While some search keywords were directly related to the primary stages of food production (agriculture and livestock), incorporating terms like “food,” “business,” and “system” into the search combinations helped broaden the results beyond food businesses in the early stages of the value chain. Additionally, while adding new keywords could have helped identify more cases, this expansion would pose challenges due to time and resource constraints, ultimately limiting the scope of our research.

2.2 Identification and review of regenerative food businesses

Each keyword combination applied to Google produced several website links (search results). To maintain a manageable scope, the review was limited to a maximum of 500 websites per keyword combination, if these were available from the initial set of search results filtered by Google. Google automatically filters the initial set of results to display only relevant entries, avoiding showing those unrelated to the topic, which are displayed only in a subsequent set of pages if manually configured. Although the total number of websites identified by Google often exceeded 10,000, the initial filtered results typically ranged between 150 and 400 entries.

The website links generated by Google were systematically reviewed to extract information on businesses employing and transitioning to a regenerative approach. The main data collected included: the type of business; location; value chain segment (e.g., production, processing, commerce); types of production systems (e.g., agroforestry, monoculture); products or services offered; enterprise size and corporate governance structure (e.g., micro, small, medium or large-sized enterprise, associative and non-associative enterprises; involve or is led by vulnerable groups); is women-led; has a community-based approach (understood as businesses that actively engage with and prioritize the needs of their local community); certifications held; use of the term “regenerative”; and other complementary variables.

Extracting business information from web-based data presented various challenges, requiring us to rely on multiple sources. For example, we identified monocultures by examining the business’s website, where they specify the types of crops they manage. We also referred to technical reports, when available, or images that indicated the presence of agroforestry or polyculture practices. Determining company size proved even more challenging. We initially assessed their scope based on website content, and when this information was unavailable, we explored other sources such as official government registration databases, company data

platforms, and social media (e.g., LinkedIn). In cases where these were still insufficient, we turned to business reports and considered factors such as farm size, production system, and processing facility size and type to make the most accurate estimation.

To identify businesses with a potential regenerative approach or those in transition toward it, we applied four criteria during the website review: (1) The business must be a food-related enterprise; (2) The business must be located within the territories of the Amazon Biome or the CADC; (3) Businesses that include the term "regenerative" or its variants in its discourse (without necessarily self-identifying as regenerative). By "variant"' of the term "regenerative," we are not referring to other agricultural movements but rather to different grammatical forms of the word in Spanish, such as *regenerativo, regenerativa, regeneração, regenerar,* and *regenerador*, which correspond to "regenerative," "regeneration," "regenerate," etc.; (4) For businesses that do not explicitly use the term "regenerative," we assessed and included those presenting a positive environmental and social impact approach, along with multiple practices aligned with these values. Although this group of businesses was often identified through interviews, they also appeared in online search results.

For this latter criterion, we looked for a combination of indicators suggesting that the reviewed business aligned with the RFB definition adopted for this study. On the one hand, we examined the business's discourse on its website for clear intentionality to prioritize nature in its approach. Specifically, we identified businesses that stated objectives or missions related to the protection, conservation, or restoration of nature, ecosystems, biodiversity, or landscapes. While environmental considerations were key to this identification, we also assessed the businesses' commitment to social aspects. This included goals to reduce community poverty, promote inclusion and equity, and strengthen community capacities and cohesion.

On the other hand, we looked for concrete actions that supported the business's stated commitments. We looked for claims or evidence of practices such as soil conservation (e.g., mulching, reduced tillage), agricultural diversification (e.g., polycultures, agroforestry systems, crop rotation), reduction or absence of synthetic inputs, certifications, landscape connectivity practices, animal welfare measures, and other sustainability efforts. While some of these practices are primarily relevant to businesses engaged in primary production, we also considered broader practices to assess the regenerative alignment of non-agricultural food businesses. These included conservation and restoration of natural areas, responsible resource and waste management (e.g., water and energy use), collaboration with Indigenous populations and other vulnerable groups, gender equity initiatives, measures for fair trade, and efforts to enhance local social and economic wellbeing.

By combining both the intentionality expressed in discourse and tangible practical actions, we identified businesses that, while not explicitly using the term "regenerative," demonstrated alignment with the RFB concept. For a better understanding of the characteristics that guided the mapping, please access the Supplementary material 2.

It is important to note that the purpose of these criteria was not to identify only "ideal" examples of businesses as outlined in the RFB definition. Rather, the goal was to include businesses in transition those that may not yet fully fit with the definition but are actively working toward and publicly demonstrating efforts aligned with a regenerative approach.

In addition to the initiatives identified through the online search, we conducted semi-structured interviews (Supplementary material 3) with individuals identified as potential key informants. These informants, primarily regeneration experts or representatives of organizations promoting the concept in the regions, were identified and registered during the review of Google results.

We reached out to 208 potential informants individually via email and phone calls to schedule interviews. As a result, we conducted 50 interviews, during which informants, after receiving an explanation of the RFB concept as adopted for this study, helped identify businesses that did not appear in the Google results based on our keyword combinations. While these businesses were not initially featured in the online search, the specific information provided by the informants (e.g., business names) allowed us to later locate and analyze their websites and additional sources. Importantly, businesses suggested by informants were not automatically included in the mapping; instead, they were reviewed and assessed using the same criteria applied to the online search results.

The information for each identified business was reviewed and organized in an Excel spreadsheet (Supplementary material 4), with each business characterized by a set of variables represented in columns. We then used Excel's PivotTable functionality to process, analyze, and summarize the dataset.

3 Results and discussion

A total of 77 search word combinations were performed, yielding 9,261,013 search results identified through Google. Following the established search protocol, 24,270 results were reviewed. The full list of search combinations, the number of Google search results, the number of pages reviewed, and the corresponding outcomes are detailed in Supplementary material 5.

3.1 Overview of businesses found

The mapping effort identified a total of 181 food businesses with a potential regenerative approach. Of these, 114 businesses are associated with the Amazon region, and 67 are linked to the CADC. Within the Amazon region, the distribution includes 1 business in Bolivia, 46 in Brazil, 16 in Colombia, 26 in Ecuador, and 25 in Peru. In the CADC, the cases identified are distributed as follows: 27 in Costa Rica, three in El Salvador, 17 in Guatemala, four in Honduras, 15 in Nicaragua, and one in Panama. The distribution of the mapped businesses, according to the target territories and according to the use or not of the term "regenerative," can be seen in the map below (Figure 1).

3.2 Business activities in the value chain

The identified businesses operated across various segments of the food system, including primary production, post-harvest and food processing, retail commercialization, fishing, food services, and food-related tourism. While some businesses focused exclusively on a single activity, others operated across multiple segments of the value chain simultaneously (Figure 2). Considering the number of activities each business was engaged in, 54 businesses were exclusively dedicated to a single activity. In contrast, a larger share participated in multiple

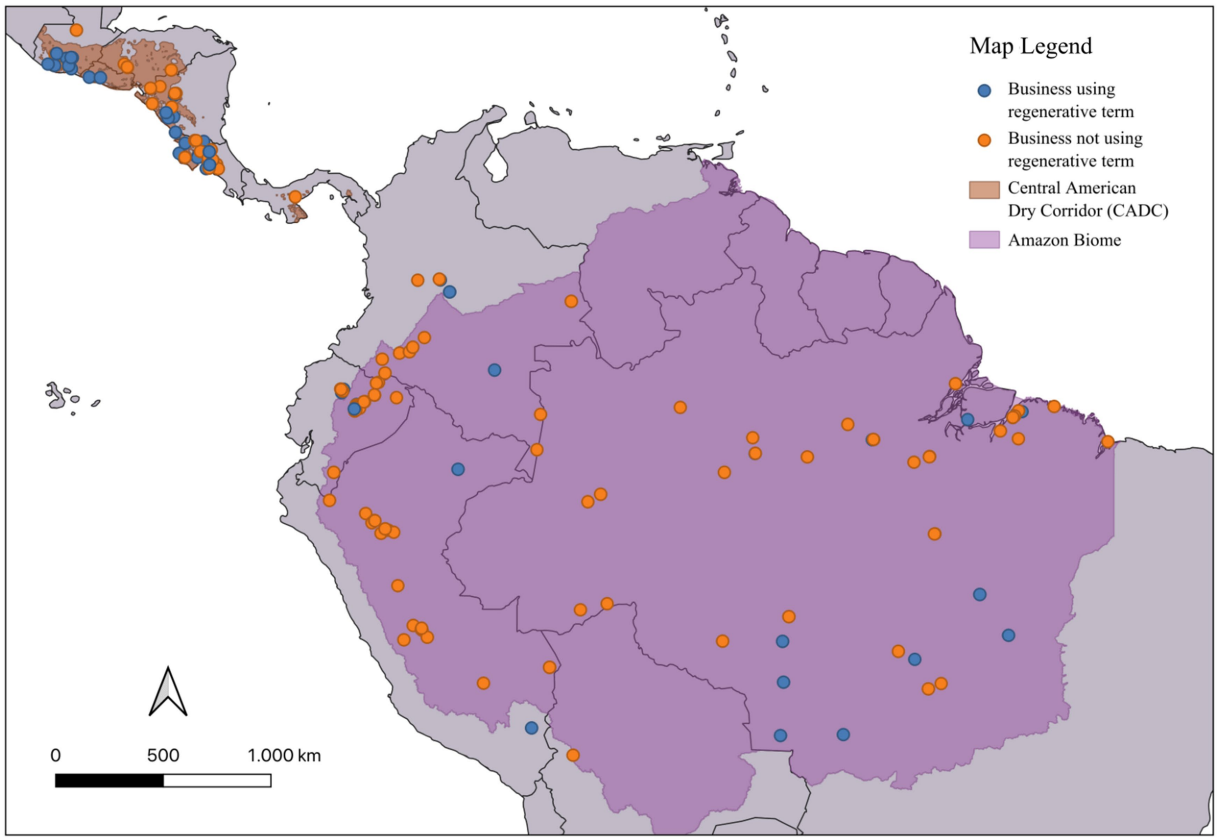

FIGURE 1
Distribution of mapped businesses by target territories and use of the term "regenerative." The blue icons represent businesses that use the term "regenerative." The orange icons represent businesses that do not explicitly use the term but were included in the mapping based on the criteria outlined in the methodology.

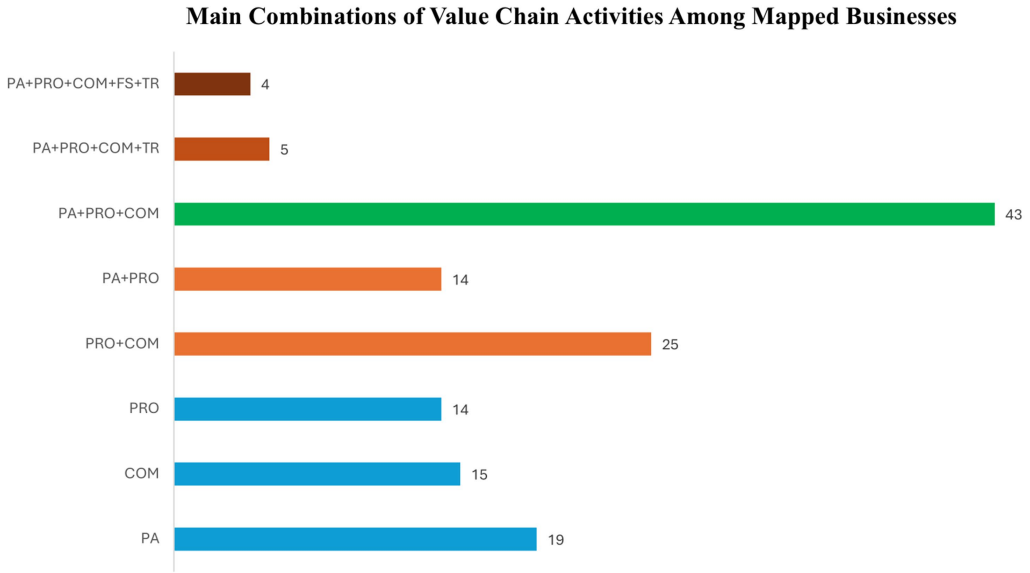

FIGURE 2
Main combinations of value chain activities among mapped businesses. The chart illustrates the different combinations of activities carried out by each business, which may engage in a single activity or simultaneously combine two, three, four, or five value chain activities. The number of activities performed is represented by color groups. The legend for the activity codes is as follows: PA, Primary agricultural production; PRO, Processing or product transformation; COM, Retail commerce; FS, Food service; TR, Tourism.

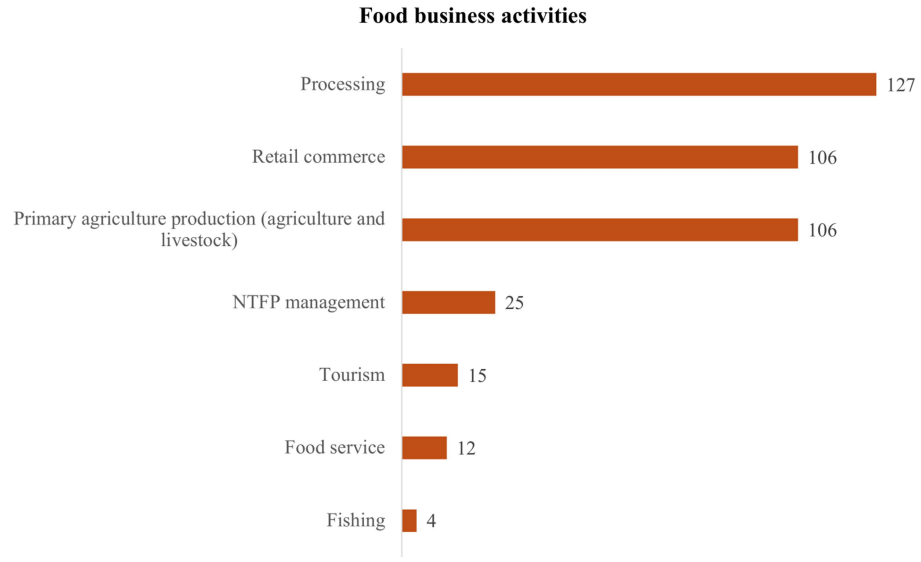

FIGURE 3
Value chain activities undertaken by identified businesses. Businesses engage in multiple activities simultaneously. Product processing and transformation are the most predominant, followed by commerce (both online and physical) and primary production (agriculture and/or livestock). Less common activities include the management of non-timber forest products (NTFPs), tourism, food services, and fishing.

activities simultaneously, with 56 businesses involved in two activities and 58 in three. Additionally, nine businesses were engaged in four activities, while four operated across five.

The most common activities were post-harvest processing and/or food product processing, involving 127 businesses, followed by 106 initiatives participating in commercial retail, and 106 businesses participating in primary agricultural production (which includes agriculture and/or livestock) (Figure 3). Non-timber forest product (NTFP) management was performed by 25 businesses. Tourism and food services, such as restaurants, accounted for 15 and 12 cases, respectively, while fishing appeared in four cases.

Although detailed information on how businesses conduct their activities was limited, the analysis revealed that among agricultural and livestock production initiatives, approximately 59 were engaged in agroforestry systems (AFS), 26 in diversified polycultures (non-AFS), and seven in monocultures. Additionally, around 17 initiatives implemented intensive or rotational livestock production, while seven employed silvopasture systems (SPS). Other activities included work with small livestock species (seven cases), beekeeping (native or exotic; two cases), and artisanal fishing (four cases).

3.3 Food products

The range of products and services offered by these businesses spans a wide array of subsectors, including fruits, vegetables, basic grains, and others. Among these, certain products stand out due to their prominence and frequency. Coffee ($n = 37$) and cocoa ($n = 28$) are particularly significant, appearing as disaggregated categories. Additionally, diverse processed products such as jellies, preserves, pastries, and similar items ($n = 25$), as well as oils and butters ($n = 22$), nuts ($n = 22$), and fruits ($n = 20$), emerge as the most commonly offered products among the mapped food businesses with a regenerative alignment (Figure 4). While the total number of businesses involved with livestock products added up to 24, the final products offered by each business varied, including cattle for slaughter or fattening ($n = 10$), dairy products ($n = 8$), and red meat ($n = 6$).

3.4 Businesses by size and type of corporate governance

The size of the businesses was estimated based on the information available on their website or other secondary sources, such as official government portals and company platforms, considering the number of employees when provided or when the business size was explicitly stated. In this context, based on the OECD (2023), enterprises with 0–10 employees were categorized as microenterprises, those with 10–49 employees as small enterprises, 50–250 employees as medium-sized enterprises, and those with more than 250 employees as large enterprises. The majority of the identified food businesses were classified as small and medium-sized enterprises ($n = 67$) and microenterprises ($n = 42$). Additionally, 11 large enterprises were identified. Associative enterprises also played a significant role, with 36 associations and 25 cooperatives[2].

When business types and sizes are matched with the main activities they perform, it becomes clearer the way they contribute to the value chain (Figure 5). In this context, primary agricultural production is relatively balanced between associative enterprises (cooperatives: $n = 16$, associations: $n = 22$) and non-associative enterprises, with small and medium-sized companies ($n = 37$) being

2 According to the International Cooperative Alliance, a cooperative is an autonomous association of individuals who have voluntarily joined together to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise.

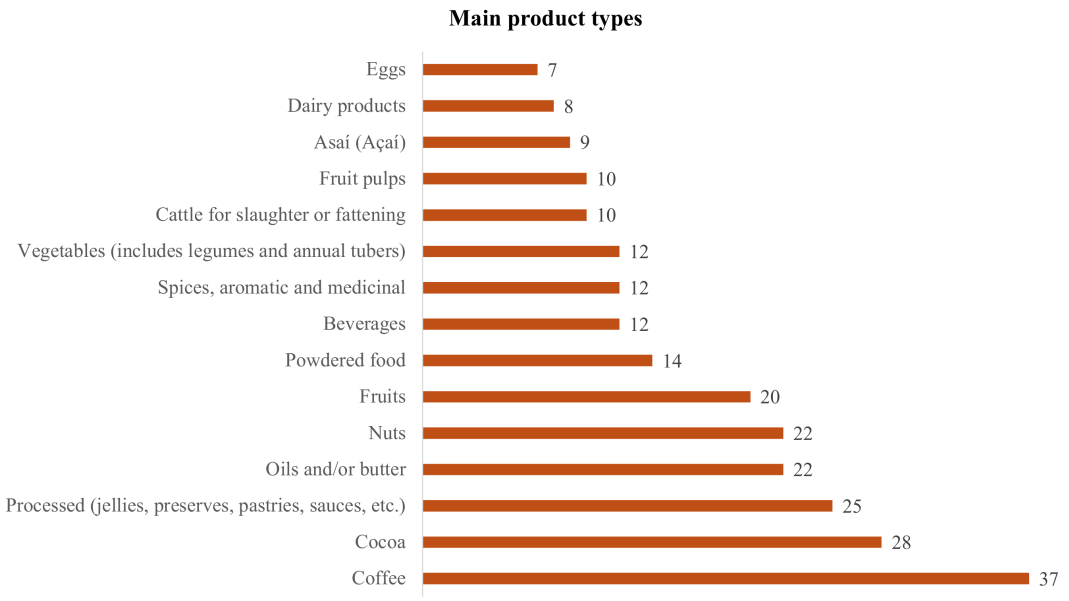

FIGURE 4
Main products offered by identified businesses. Coffee, cocoa, processed foods, oils and matecas, nuts, and fruits are among the most represented business products.

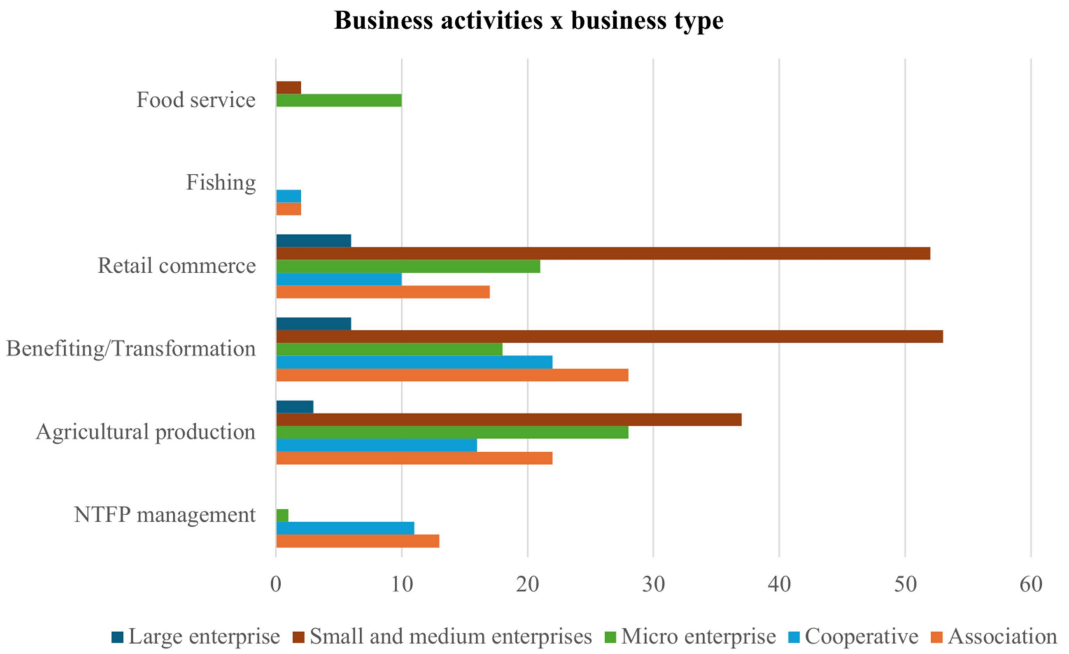

FIGURE 5
Value chain activities by business type. The management of non-timber forest products (NTFPs) is primarily carried out by associative enterprises (cooperatives and associations). All business types engage in primary agricultural production, processing, and commerce. Small and medium-sized enterprises (SMEs) play a significant role in processing and commercialization. Fishing is exclusively undertaken by associations and cooperatives, while food services are primarily led by micro and small to medium-sized enterprises.

the most representative. A similar scenario was observed in food processing activities, where small and medium-sized enterprises dominate ($n = 53$), followed by cooperatives ($n = 22$) and associations ($n = 28$). However, this balance shifts in the case of retail commerce, where non-associative enterprises dominate ($n = 78$). Similarly, in the case of non-timber forest products (NTFP), non-associative enterprises show minimal participation, while associations ($n = 14$) and cooperatives ($n = 11$) play a much larger role.

In a separate analysis, we examined the distribution of main products across different types of businesses. The findings reveal that

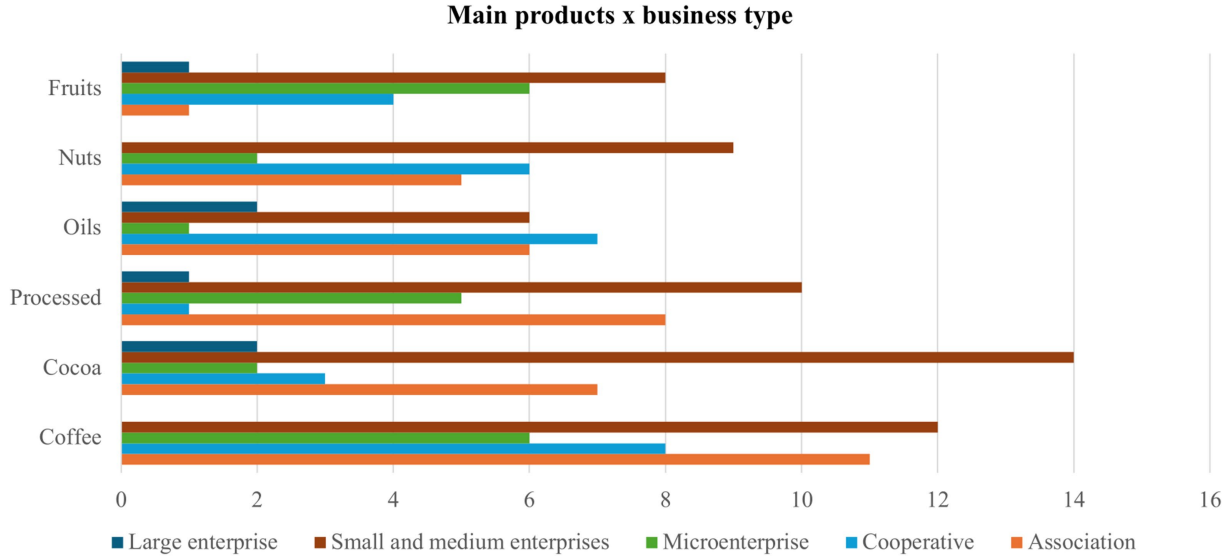

FIGURE 6
The six most representative products by business type. Associations, cooperatives, small and medium-sized enterprises (SMEs), and micro-enterprises are involved in the production of all major products. In contrast, large companies primarily focus on cocoa, processed products, oils, and fruits. While SMEs have a strong presence across all product categories, Associations and Cooperatives stand out particularly in oil production.

coffee and nuts are relatively evenly distributed between associative and non-associative enterprises, with small and medium-sized enterprises dominating the latter category (Figure 6). In contrast, cacao, fruits, and processed products are more frequently produced by non-associative enterprises. Oils and butters, primarily classified as non-timber forest products (NTFPs) and often sourced through community forest management, are predominantly produced by cooperatives and associations.

3.5 Integration of disadvantaged and vulnerable groups

Despite the limited availability of detailed data in the reviewed online sources, the mapping identified regenerative businesses led by or involving Indigenous peoples, women, Afro-descendants, traditional groups, and community-based organizations. Although not inherently vulnerable, these groups often face heightened exposure to economic disadvantages, harm, or discrimination due to social, economic, or geographic conditions. Of the 181 businesses mapped, 103 were managed by or connected to these groups, 44 were not, and information was unavailable for 34 cases. Among the 103 cases, 53 were managed by or involved Indigenous peoples, 30 by groups of women, 14 by riverside communities, two by Afro-descendants, and one by social movements. Additionally, 32 cases were associated with other traditional populations, and three initiatives included the participation of immigrants. It is important to note that the total count exceeds 102 due to intersectionality, as some businesses reflect multiple dimensions of vulnerability, such as initiatives managed by groups of Indigenous women.

The businesses neither managed by nor integrating vulnerable populations are more prevalent in the CADC. It is also important to note that associative enterprises (cooperatives and associations), which are led by or integrate vulnerable groups, are more present in the Amazon biome businesses ($n = 51$) compared to the CADC ($n = 10$).

When cross-referencing information about the participation of vulnerable groups with the types of businesses (Figure 7), it becomes clear that the integration of vulnerable groups is relatively balanced between associative businesses—such as associations ($n = 34$) and cooperatives ($n = 16$)—and non-associative businesses, including micro-enterprises ($n = 19$) and small and medium enterprises ($n = 34$). However, the types of businesses most often directly managed by vulnerable groups are associations ($n = 27$) and cooperatives ($n = 13$), compared to micro ($n = 6$) and small and medium-sized enterprises ($n = 6$).

The organization of communities into cooperatives or associations represents a strategic approach to strengthening socioeconomic conditions within territories, building capacities, and fostering family participation across various sectors (Majee and Hoyt, 2011; Billiet et al., 2021). Additionally, Vázquez Maguirre et al. (2018) highlight that social enterprises led by Indigenous communities contribute significantly to the sustainable development of their territories. These enterprises distribute benefits equitably across social, economic, and environmental dimensions while addressing gender inequality. Locally managed business models rooted in community values are pivotal for promoting regeneration and, when well-managed, ensuring long-term impact.

Information regarding women's leadership in the identified food businesses was limited. Of the 181 cases, 65 lacked data on this aspect. For the remaining 115 RFBs, it was found that women led 48 businesses, while 68 were not led by women. The study was able to address female leadership based on secondary sources, but this data is limited when aiming to deepen the discussion on how gender perspectives are integrated into potential regenerative businesses. To gain a comprehensive understanding of this issue—both within and around the business—it is essential to explore each case more closely

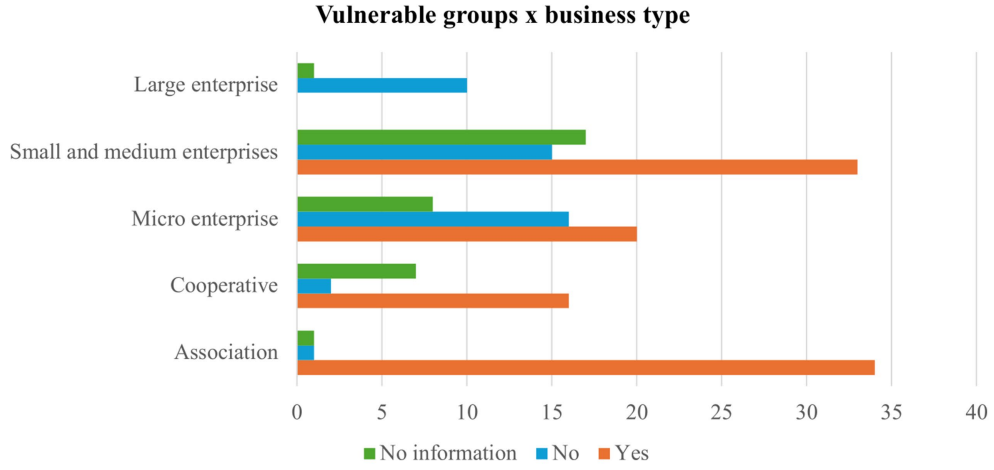

FIGURE 7
Integration of vulnerable groups by business type. While the inclusion of vulnerable groups, such as Indigenous peoples and Afro-descendants, is present in small, medium, and micro enterprises, it is significantly higher in associative enterprises (associations and cooperatives). In these businesses, vulnerable groups play a central role, with only a few cases where they are not involved.

through additional sources of information, primarily primary data, to obtain an accurate picture of the situation.

Despite gaps in the information related to leadership within the 181 cases identified, the results revealed that women's participation in leadership roles was lower compared to men, reflecting a global trend still in transition (Flabbi et al., 2016; Alqahtani, 2020; UN Women, 2023). Nevertheless, while this scenario is evident, the percentage of women (41%) in leadership positions within the mapped businesses with available information is more encouraging than the global figure reported by UN Women (2023), which states that women hold only 28% of executive roles in the workforce. Furthermore, although gender gaps in Latin America and the Caribbean have been narrowing due to stronger policies and increased integration of women into the economy, further progress is still needed (WEF, 2024).

Finally, the community-based approach emerged as a significant aspect. Among the identified RFBs, 61 were managed by communities, while 50 were not directly managed by communities but were strongly involved and articulated with them. Additionally, 47 cases did not exhibit a community-based approach, and for 23 cases, there was insufficient information to categorize this aspect.

3.6 Use of the "regenerative" term

The use of the term "regenerative" and its variants (e.g., regeneration, regenerate) by businesses was a key focus of this research. While we acknowledge that some businesses may use the term primarily for marketing purposes potentially in a greenwashing context (Tittonell et al., 2022; Gordon et al., 2023; Wilson et al., 2024; Bless, 2024) or may be less "regenerative" in practice than others that do not use the term, it is crucial to understand how the concept is being adopted in the two regions studied. Therefore, regardless of the precise meaning, we recorded businesses that included the term in their narrative or presentation.

Of the 181 businesses mapped, 64 used the term "regenerative," while the remaining 117 did not adopt this concept (these businesses either appeared in the online search results or were recommended by key informants and were included after assessing their discourse and practices, as outlined in the methodology). Among those businesses using the term, the majority were in the CADC region ($n = 36$), with the rest in the Amazon ($n = 28$). Brazil had the highest number of businesses using the term ($n = 14$), followed by Guatemala ($n = 13$), Costa Rica ($n = 12$), and Nicaragua ($n = 9$).

Considering the disparity in territorial size between the CADC and the Amazon biome, the prevalence of the term "regenerative" in the CADC can be attributed to several factors. While the Amazon is vast, many rural collectors and producers remain isolated from urban centers and tourist hubs where the "regenerative" concept is more likely to emerge as a trend. Second, Central America attracts a significant number of tourists from the U.S. and Europe (WTO, 2024), some of whom settle in key natural areas in search of alternative lifestyles. The influence of the "regenerative" trend originating from the Global North (Tittonell et al., 2022) may also play a role in shaping this dynamic in Central America.

Last but not least, it is very interesting to see how the term is distributed among the different business types. In the case of this mapping, it is evident that the "regenerative" concept is exclusively adopted by the non-associative businesses, while the associative enterprises like associations or cooperatives do not use the term.

Based on these results, it is worth noting that the adoption of this term, often linked to a discourse of "innovation," is almost exclusively associated with non-associative businesses, despite many regenerative practices and values being rooted in Indigenous knowledge and culture. In contrast, associative businesses, often led by vulnerable populations, tend to either overlook or remain unaware of the "regenerative" narrative, or may prefer using a different term. Instead, they typically use the term "sustainable" as an umbrella for their actions or emphasize a discourse centered on connection with nature and ancestral knowledge. Chesnais (2020) and Sands et al. (2023) emphasize the importance of recognizing that the "regenerative" discourse in food systems continues to

colonize the knowledge and practices deeply rooted in Indigenous and ancestral communities. These communities, which have historically embodied regenerative cultures, are often overlooked or excluded from this conversation.

3.7 Characteristic of businesses that use the term "regenerative"

It is estimated that 22 of the businesses using the term "regenerative" are microenterprises, 33 are small or medium-sized enterprises, and seven are large corporations. Of the total, 12 operate solely at the base of the value chain, focusing on agricultural or livestock production. Meanwhile, six combine primary production with processing or value-added activities, and 16 manage production, processing, and direct marketing. Additionally, 16 businesses focus exclusively on marketing and/or processing.

Among the 35 businesses engaged in primary production, 19 incorporate agroforestry systems into their operations. The prominence of agroforestry systems within the regenerative landscape of Latin America is particularly noteworthy, as these systems are increasingly recognized for their potential to mitigate the impacts of climate change while providing better financial returns for farming families (Elevitch et al., 2018; Vidadala, 2024). At the same time, it is important to highlight that the few "regenerative" initiatives adhering to a monoculture model are predominantly large corporations ($n = 3$).

The inclusion of these three businesses operating monoculture production systems was due to their use of the term "regenerative" and associated practices (e.g., soil cover, crop rotation, and others). Although productive diversification is not a definitive factor in the literature for determining whether something is regenerative, it is widely highlighted as having great potential for regenerating agricultural systems (Tamburini et al., 2020; Jayasinghe et al., 2023). On the other hand, the profile of these mapped corporations aligns with that of other large, historically monoculture-based corporations that are now using the term "regenerative" (CEBDS, 2023; SAI, 2023). It is interesting to note that in practice, some of these corporations face difficulties in proving the impacts or advances they typically promise in their promotional rhetoric (Boucher et al., 2023), which often places them under scrutiny for potential greenwashing.

The products managed by these businesses range from fresh foods such as fruits, grains, and vegetables to specialty commodities like coffee, cacao, açaí, and a variety of nuts. They also include processed products with added value, such as jams, preserves, butters, oils, powders, and specialty beverages, as well as meats (primarily beef) and dairy. In this context, only one business focused its production on bio-inputs. This is a very small number, considering the crucial role of bio-inputs in the transition and scaling of regenerative agricultural businesses, as well as the vastness of the territories studied. Despite the mapping limitations, this highlights the stark contrast between the accessibility of synthetic input packages versus biological inputs—a disparity driven by a series of barriers that must be addressed for this market to grow at a Latin American scale (Bullor et al., 2024). On the other hand, this does not diminish the importance of on-farm production of bio-inputs, which aims to reduce costs associated with external inputs and ensure a production free from synthetic inputs (Matt, 2023).

It is also worth noting that only 15 of the businesses adopting the term are led by women, and just one is led by an Indigenous community. Furthermore, 22 businesses actively engage vulnerable populations in their operations, while 29 do not. In this aspect, information was unavailable for 10 businesses. The considerable fraction of businesses engaging with vulnerable groups suggests that social aspects of community wellbeing have gained particular importance within the regenerative movement in this region. This trend may reflect a broader recognition among these businesses that regeneration extends beyond environmental concerns to encompass social equity and inclusion as fundamental pillars, aligning with various interpretations of regenerative agriculture that encompass the social dimension (Jayasinghe et al., 2023; ROA, 2023).

Regarding the founding dates of businesses using the term "regenerative," 13 businesses were established before 2000, 12 between 2001 and 2010, and 24 between 2011 and 2021. Fifteen businesses lack a recorded founding date. The fact that 24 businesses adopting the regenerative approach were founded after 2011 aligns with the trend identified by Newton et al. (2020) and Giller et al. (2021), whose meta-analysis highlights a significant rise in the use of the term starting in 2015.

3.8 Is regenerative organic?

Of the 181 businesses, only 43 have organic certification, 26 hold Fair Trade certification, and just three are certified for regenerative agriculture. Notably, among the 64 businesses that use the term "regenerative," only 13 have organic certification, and seven hold Fair Trade certification. While the absence of certification does not necessarily indicate that a business is not organic, the fact that only 20% of businesses claiming a regenerative approach also have organic certification suggests that most adopters of the term "regenerative" do not consider organic production a defining factor in characterizing their practices as regenerative. On the other hand, the low number of businesses identified as certified for regenerative agriculture further highlights that this is still an emerging field, with certification and labeling standards continuing to mature within the broader agricultural landscape, as explored by Elrick et al. (2022).

The debate surrounding regenerative agriculture and organic production remains unresolved, reflecting the lack of consensus on the definition of regenerative agriculture (RA) and ongoing disputes over its core principles (Bless et al., 2023; Khangura et al., 2023; Mambo and Lhermie, 2024). Whether organic production should be considered a prerequisite for RA is still under discussion, with no consensus reached. Some view organic farming as a potential goal for RA but not a strict requirement (Rempelos et al., 2023; Schreefel et al., 2020). Others, however, argue that true "regenerative" practices do not use synthetic inputs (ROA, 2023). This lack of clarity likely contributes to the opportunity for greenwashing (Bless, 2024; Gordon et al., 2023; Page and Witt, 2022). The term "regenerative" has gained traction in the past decade (Giller et al., 2021) and is increasingly adopted by companies and corporations with long-standing, often irreversible negative environmental and human impacts (Devi et al., 2022) which contrast with different regenerative agriculture principles, particularly those focused on maintaining terrestrial biodiversity, soil biota, soil functions, ecological balance, and human wellbeing.

4 Conclusion

This study provides one of the first mapping exercises of food businesses pursuing a regenerative approach across different countries of the Amazon and the CADC and represents one of the few contributions to the literature that includes data from Latin America. These findings clarify the current use and profile of the term "regenerative" in these regions while identifying gaps for further exploration, such as extending the research to other Latin American biomes and considering initiatives that operate beyond the explicit use of the "regenerative" terminology.

A notable observation is the multifunctionality of the identified businesses, with over 60% engaged in two or more activities within the food value chain, including agricultural production, non-timber forest products, processing, and commercialization. This suggests that regenerative businesses are increasingly adopting vertical integration and value-adding strategies to enhance financial sustainability and offset production costs.

Interestingly, only 64 businesses explicitly use the term "regenerative" or its variations, such as "regeneration" or "regenerate." The distribution of businesses using "regenerative" terminology is notably higher in the CADC compared to the Amazon, with all such businesses being non-associative and typically private enterprises. By contrast, cooperatives and associations, often composed of Indigenous peoples and women's groups, represent a significant portion of the mapped cases despite not explicitly using "regenerative" terminology. These organizations can be critical drivers of regenerative impacts within their territories, addressing socio-environmental challenges while promoting local participation. They account for over half of the cases analyzed, underscoring the importance of recognizing their contributions to regenerative outcomes, even if their efforts are not explicitly labeled as such.

The results of this mapping provide a valuable foundation for informing more effective efforts to promote and develop regenerative food businesses (RFBs). By understanding the distribution and characteristics of these initiatives across regions, this study lays the groundwork for further action, including a deeper analysis of the barriers they face and the enabling conditions that support their growth. Key aspects for further exploration include value chain dynamics, market access, financial services, gender equity, and the external environments in which these businesses operate.

A more detailed examination of the businesses identified in this mapping could offer crucial insights into their access to markets and financial services, the availability of key production inputs (such as bioinputs for scaling), and their needs for technical support and capacity-building, among others. Understanding these factors will be essential to strengthening existing policies and informing the development of new ones that effectively support RFBs.

Ultimately, deeper policy analysis across different territories can help identify existing policies that, while not originally designed for regenerative models, may share principles and practices that align with regenerative initiatives. Recognizing these overlaps can foster better integration and synergies between regeneration and analogous movements, providing decision-makers with the insights needed to drive policies toward more sustainable and regenerative directions.

4.1 Mapping limitations and recommendation for next steps

The first aspect to consider when reviewing the results of this research pertains to the keywords used in the online search. On one hand, the use of the term "regenerative" and its variations allows for a focused exploration of the "regenerative movement" and its adoption. On the other hand, it limits the ability to identify a broader range of businesses that may qualify as RFBs but do not use the term, potentially excluding them from the search results. Nonetheless, even with a focus on "regenerative" keywords, it was notable that most businesses identified in this study did not explicitly adopt the term, but were included due to their regenerative-aligned discourse and claimed practices. This suggests that while a significant number of businesses may align with the RFB concept, the movement of food businesses around this particular term remains in its early stages and continues to evolve in the two regions studied.

Building on this, further efforts are needed to gain a more comprehensive understanding of the spread of Regenerative Food Businesses beyond the term's direct use. While applying additional keywords, such as "organic," "sustainable," and "permaculture," may extend beyond certain definitions of "regenerative" agriculture, the movements associated with these terms share similarities with the concept of regeneration. Including these keywords in the online search would broaden the initial set of results, allowing for the review and potential identification of more businesses aligned with the RFB concept presented in this study, even if they do not explicitly use the "regenerative" term.

Besides that, expanding the search to utilize other search platforms, including social media and to include other regions of Latin America could also provide a more comprehensive understanding of regenerative approaches adoption. However, these additional efforts would require significantly more time and resources.

Additionally, it is important to recognize that, given the scope and duration of this research, the data sources used were selected for their accessibility. However, secondary data is often limited and not always reliable, as verifying the information can be difficult. Moreover, since RFBs are involved in various activities and transition phases, it is challenging to apply strict and universal criteria for inclusion in the mapping. While the criteria offer guidance for optimal selection, it is important to note that it cannot be definitively concluded that the businesses mapped are "regenerative" in practice. However, it can be affirmed that their practices are closely aligned with the regenerative approach. Therefore, it is recommended that future studies and users of the mapping information consider integrating fieldwork or other primary data collection methods to further validate the study information and new findings.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: to prevent the misuse of data from the mapped businesses, the information will be made available through direct contact with the authors. Requests to access these datasets should be directed to BA, naregenerativo@gmail.com.

Author contributions

MY: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. BA: Conceptualization, Data curation, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. DB: Investigation, Writing – review & editing. VB-M: Investigation, Writing – review & editing, Supervision. RG: Investigation, Writing – review & editing. CR: Investigation, Writing – review & editing. HC: Writing – review & editing. GD: Project administration, Writing – review & editing. PV: Project administration, Writing – review & editing.

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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.

Generative AI statement

The authors declare that Gen AI was used in the creation of this manuscript. The author use of OpenAI's ChatGPT (version 4.0) as an initial translation tool for this article from Spanish to English, followed by a secondary review process.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2025.1546626/full#supplementary-material

SUPPLEMENTARY MATERIAL 1
Mapping control matrix.

SUPPLEMENTARY MATERIAL 2
Mapping criteria.

SUPPLEMENTARY MATERIAL 3
Key actor interview protocol.

SUPPLEMENTARY MATERIAL 4
Secondary information matrix.

SUPPLEMENTARY MATERIAL 5
Results Google search.

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