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Options to Support Sustainable Trajectories in a Rural Landscape: Drivers, Rural Processes, and Local Perceptions in a Colombian Coffee-Growing Region

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Abstract: Trajectories of many rural landscapes in Latin America remain unsustainable. Options to support sustainable rural trajectories should be comprehensive and rooted in the interests of rural actors. We selected a municipality in a coffee-growing region in Colombia with an increasing urban–rural nexus to describe interactions between rural processes and their drivers while identifying and contextualising the perceptions of local actors on major constraints and opportunities for more inclusive and sustainable rural trajectories. We described these interactions by combining secondary data on main drivers, agricultural census data, and interviews with different local actors. Changes in population structure, volatility in coffee prices, in-/out-migration, deagrarianisation, and rurbanisation, among others, are reconfiguring the rural trajectories of the study area. Despite not being a major coffee region, farmers in the study area have developed different strategies, including intensification, diversification, replacement or abandonment of coffee production, and commercialisation. The perceptions of local actors and the multiplicity of agricultural households, food/land use systems, rural processes, and drivers described in this study suggest that more sustainable rural transitions need to be supported by inclusive, integrated, and transformative landscape planning approaches that align with local priorities. However, this transformation needs to be accompanied by changes at a systemic level that address the fundamental bottlenecks to real sustainability.

Keywords: family farming; urban–rural nexus; integrated landscape management; land use planning; Latin America

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1. Introduction

Trajectories of many rural landscapes in Latin America remain unsustainable in spite of the pressing need to reduce and mitigate the negative impact of human activities on the environment while improving the wellbeing of the rural population [1,2]. Habitat transformation, soil erosion, environmental pollution, and climate change, among others, affect not only the livelihoods and adaptive capacity of the (local) communities, but also the biodiversity and provision of essential ecosystem services such as climate mitigation and water regulation [3,4].

These rural trajectories are shaped by the (re)action of local communities to socio-economic and environmental drivers and by local processes interacting at different spatial scales [5,6]. For example, land use decisions on agricultural commodities depend on the interaction between more distant or global drivers (e.g., international markets, climate change) and local processes such as migration, deagrarianisation, agricultural intensification, land use simplification and diversification, and environmental degradation and restoration [3,7–9]. The influence of the socio-economic and environmental drivers on these rural processes is shaped by the increasing connection of the rural landscapes to

urban centres, which not only offers access to services, social diversity, labour markets, and physical connectivity, among others (i.e., urban-rural nexus) [9], but can also escalate the competition for essential resources such as land, water, food, and labour [10,11].

Specifically, coffee landscapes across Latin America are undergoing rapid transformations, with changes in coffee varieties, management of shade and inputs, and/or land use [12]. The culture, identity, and livelihoods of many communities remain directly or indirectly dependent on coffee production and its commercialisation [8,13]. Yet, the continuity of coffee production in the region is under pressure due to decreases in profitability, the high volatility of coffee prices, lack of adequate technical support, and the effects of climate change, among others [14–16]. Many smallholder coffee farmers are therefore facing mounting economic pressure to intensify and/or replace coffee production. Yet, smallholder agroforestry coffee production and commercialisation have the potential to improve rural livelihoods while maintaining essential ecosystem services [8,17]. For example, although still limited, new niche economies have flourished, demanding multiple services from coffee-growing regions, such as leisure/tourism, nature conservation, and healthy and sustainable food production, that have the potential to benefit the producer, the consumer, and the environment [18,19].

However, information about how, where, and why these changes in coffee-growing regions are occurring, and what the perceptions of local actors are towards the processes behind these trajectories, is often missing. Without a more detailed understanding of the interactions between drivers, rural processes, and local perceptions, it is difficult to identify which trajectories in coffee landscapes are beneficial for rural livelihoods, for climate change mitigation and adaptation, and for sustainable development more broadly. It also makes it difficult to identify which types of policies, programmes, or investments may be needed to promote more sustainable rural landscapes [12].

Colombian coffee-growing regions exemplify the need to understand and improve the sustainability of their trajectories [20,21]. For example, local communities are vulnerable, with nearly half of rural households still considered poor [22]. At the same time, agricultural intensification and diversification have resulted in a reduction in agroforestry systems and coffee plantations in some coffee-growing regions in Colombia [20]. For this study, we selected as an example a municipality in a coffee-growing region located close to a major urban centre to describe how rural processes and their drivers shape the rural trajectories in this area and to contextualise the perceptions of local actors on the main constraints and opportunities for fostering more inclusive and sustainable rural landscapes. This study combines the analysis of secondary (historical) data and semi-structured interviews with local actors to draw a broad picture of the current and future potential and preferred rural trajectories in a region where coffee is still part of the identity of the rural community and the landscape.

2. Methods

2.1. Study Area

2.1.1. Description of the Study Area

This study was conducted in Guayabal de Síquima (GdS), a municipality with 12 villages located in the province of Cundinamarca in the centre of Colombia (see Figure 1). The municipality has an altitude of approximately 1600 m above sea level and it is located 69 km from the capital city, Bogotá. GdS is part of one of the seven coffee-growing regions in Cundinamarca, where coffee is produced in more than half of the municipalities and continues to be part of the income of 31,000 families [23]. In GdS, 77% of the population lives in rural areas [24]. The local economy is largely dependent on the agricultural sector, which is dominated by smallholders producing food mostly for self-consumption combined with coffee and sugar cane production for the market. Dairy production and poultry farming are also part of the land use and local economy. We selected this municipality because it represents the situation of many other municipalities in Colombia: a rural region with a

strong urban–rural nexus where agriculture (and coffee) production is still an important component of the rural livelihoods and land use.

Figure 1. Location of Guayabal de Síquima. Uppercase text and dark red lines represent the names and borders of villages. Numbers and contour lines represent altitude in metres above sea level.

2.1.2. A Brief History of Coffee Production in the Region

Cundinamarca was one of the first provinces where large-scale coffee production began in the second half of the 19th century in Colombia [25]. Originally, coffee production depended on large *haciendas* with semi-servile labour, reflecting the high economic and political inequality in the region [26]. The first decades of the 20th century witnessed a transformation in coffee production in Colombia: The bulk of coffee plantations moved to the central areas of the Andes, family farming began to dominate coffee production instead of the *haciendas*, and the National Federation of Coffee Growers of Colombia (FNCC by its abbreviation in Spanish) was consolidated [27,28].

After the 1980s, an outbreak of coffee rust in the country (*Hemileia vastatrix*) led the FNCC to promote new coffee varieties resistant to rust, cultivated in more medium- and large-scale intensive production systems with less shade/trees and at relatively higher altitudes, reconfiguring the landscape in many coffee-growing areas in the country [20,27]. At the same time, the processes of industrialisation and urbanisation created a more complex urban–rural structure in some coffee regions in terms of migration, labour demand, and transportation [27]. The transition to the 21st century experienced a drop in coffee prices that resulted in rural poverty, violence, and poor governance in many coffee-growing regions in the country [29,30]. To mitigate the decreasing local and global demand of previous years, the FNCC launched a programme in 2009 to promote domestic coffee consumption [31]. In the last decades, improvements in infrastructure and better access to information and communication technologies (ICT) are redefining the urban–rural nexus

in some of these coffee-growing areas (e.g., increasing in-/out-migration, better access to urban markets) [32].

2.2. Data Collection and Analysis

Three main complementary analyses were conducted. Initially, the general dynamics of major drivers affecting the study area were described. Furthermore, the main land-use patterns and coffee farming were described for the area. Lastly, local actors were interviewed to identify the main constraints and opportunities for fostering more inclusive and sustainable rural landscapes, from their perspective.

2.2.1. Dynamics of Rural Processes and Their Drivers

Secondary historical, administrative, and census data were collected in early 2020 to understand and contextualise the different tendencies of the rural processes and their drivers. Changes in the population structure were studied to understand the dynamics of the local population. Farm number and size were included to describe the process of farm fragmentation and rurbanisation. The amount of area, productivity, intensification (i.e., conversion from traditional and old to new plantations), and price variability of the coffee were used to contextualise the dynamics of coffee production of the study area. These data were spread across different organisations, available at different levels (provincial and/or municipal) and across different time spans.

To understand the population dynamics, we obtained historical data on urban and rural population, and population structure from the census data (available years 1985, 2005, and 2018) from the National Administrative Department of Statistics (DANE by its abbreviation in Spanish). For the calculation of farm fragmentation, data on the number of farms, total farm area, and average farm size were collected and calculated from the Statistical Yearbooks of the Planning Office in Cundinamarca (years 2000 to 2018). To study past tendencies of coffee areas (years 2007 to 2017), coffee production and intensification (years 2002 to 2019) in Cundinamarca and GdS, and national coffee prices (years 2000 to 2019), data were extracted from both the Annual Agricultural Yearbook of the Ministry for Agriculture and Rural Development and the Statistical Yearbooks of the FNCC. Coffee prices for the internal market were represented with constant prices (that is, converted to USD relative to December 2019), combining the historical National Bank exchange rate (https://www.banrep.gov.co, accessed on 10 February 2020) and the historical monthly Consumer Price Index (https://federaciondecafeteros.org/wp/estadisticas-cafeteras/, accessed on 5 February 2020). A monthly coffee price difference was calculated to plot the variability of coffee prices. This difference was calculated as the percentage of the monthly price that changed in the following month.

2.2.2. Land Use and Coffee Farming in Guayabal de Síquima

Analyses of land use and coffee farming in the municipality were conducted to give a better understanding of ongoing rural processes in the study area. This analysis was based on data from the most recent National Census of Agriculture conducted in 2014. These data included socio-economic and agricultural information at the farm level, such as family and farm sizes and main land uses, including coffee, other crops, grassland, and forested areas, among others. Farm data were aggregated at the village level to better understand the variability of land use and coffee farming in the 12 villages of the study area. The analysis on land use included not only the main uses/cover of each village, but also the agricultural area, the number of farms, the share of the smallholdings (<2 ha), the livestock number and density, and the importance of coffee in terms of the share of coffee farms and area. The analysis on coffee farming included the number of farmers, their age, farm size, the area of the farm covered by coffee, whether coffee was associated with other vegetation cover and/or livestock, and whether they had had problems with drought in the previous year. Data manipulation and descriptive analyses of the census data were performed in RStudio.

2.2.3. Rural Processes and Local Options

A set of 29 semi-structured interviews was conducted to obtain an overview of the perception of local actors on coffee farming and production, main constraints, rural processes, and opportunities to move towards a more inclusive and sustainable rural landscape. The main options and statements included in these interviews were preselected by combining informal discussions with local actors together with explorative analysis of the main drivers. Interviews were conducted at the beginning of 2020, with 17 coffee farmers, 6 former coffee farmers, and 6 community leaders. The interviews took place in 6 villages, including Chiniata, el Trigo, Manoa, Pajonal, Picacho, and Pueblo Viejo (see Figure 1). The selection of participants was based on the snowball sampling technique, in which the interviewee suggests other potential interviewees.

Questions included information about household and farm structure, coffee production and constraints, level of agreement or disagreement on farming (Likert scale), whether they thought the preselected rural processes would continue, and open questions on their views and potential options to address these processes in the future (i.e., increased rural–urban migration, deagrarianisation, intensive poultry production, abandonment of coffee production, rurbanisation, deforestation, and water scarcity). For data analysis and due to the agricultural and socioeconomic contrasts, the 17 coffee farmers were subsequently divided into 11 local farmers native to the study area and 6 migrant farmers who moved from urban centres to live and work in the region. Descriptive analyses were conducted to examine the data on household and farm characteristics, coffee production, and their level of agreement or disagreement, and a thematic method was followed to code and group the answers of the interviewees on the potential future options.

3. Results

3.1. Rural Processes and Drivers

Analysis of the rural processes and their drivers, in the study area and across the province, provided a context on patterns and/or trends in population structure (Figure 2), farm fragmentation, coffee area, productivity, intensification, and price variability, at different scales (Figure 3). In terms of the population patterns, the proportion and size of the rural and urban population did not change dramatically in the last few decades (Figure 2a). However, the age structure of the population went from being expansive in the 1980s to a more stationary population structure in the late 2010s (Figure 2b). This means that it shifted from a young and growing population to a more static one without a clear dominant age range.

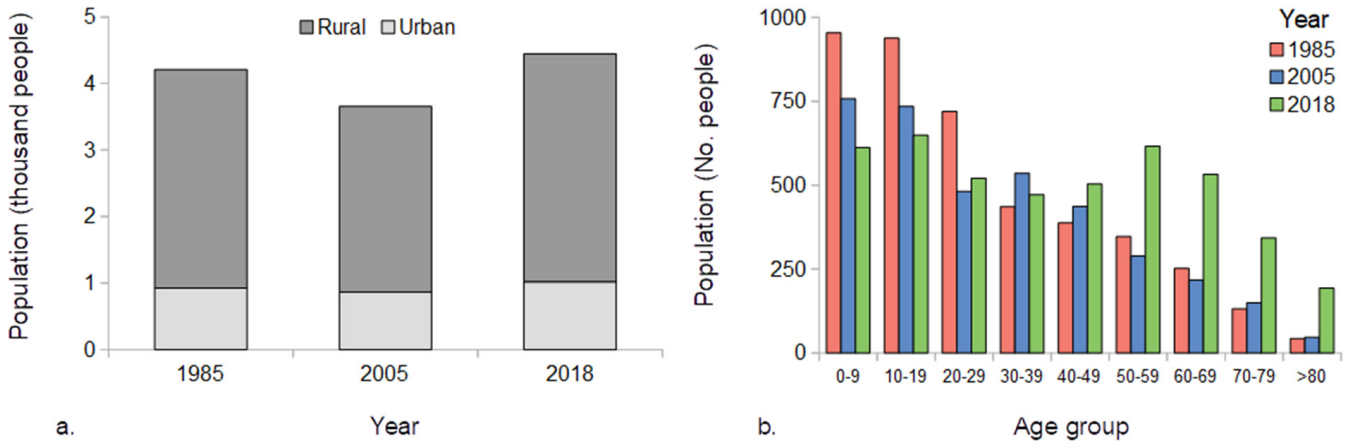

Figure 2. Population structure and changes in Guayabal de Síquima: (**a**) urban vs. rural; (**b**) age groups. Source: DANE https://www.dane.gov.co/files/censo2018/informacion-tecnica/CNPV-2018-Poblacion-Ajustada-por-Cobertura.xls (accessed on 21 January 2020).

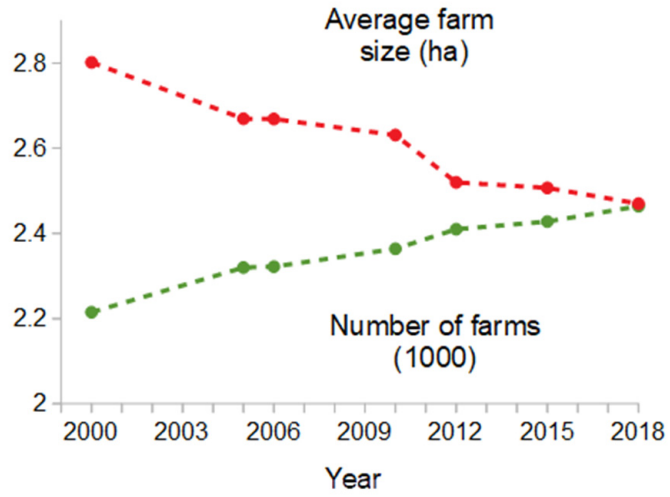

Figure 3. Changes in the number and the size of the farms in GdS. Source: Cundinamarca Secretary for Planning http://www.cundinamarca.gov.co/Home/SecretariasEntidades.gc/Secretariadeplaneacion/SecretariadeplaneacionDespliegue/asestadisticas_contenidos/csecreplanea_estadis_anuario (accessed on 30 January 2020).

Farm fragmentation has been a constant process during the last two decades. The number of farms increased by 10% and the average farm size decreased to less than 2.5 ha (Figure 3). Between 2002 and 2018, the coffee area in Cundinamarca dropped from 64,000 to 37,000 hectares. This also represented a reduction in the share of Cundinamarca in the total coffee area in Colombia from 6.4% in 2002 to only 3.4% of the national area in 2018 (Figure 4). This reduction was accompanied by coffee intensification (i.e., rust-resistant coffee varieties, higher coffee tree density, and greater use of inputs), reducing traditional coffee systems from 36% to 6% of the total coffee area in Cundinamarca. In relation to the establishment of new plantations, coffee productivity slightly decreased in 2017, reaching 0.4 ton/ha in the study area and 0.8 ton/ha in Cundinamarca (Figure 5).

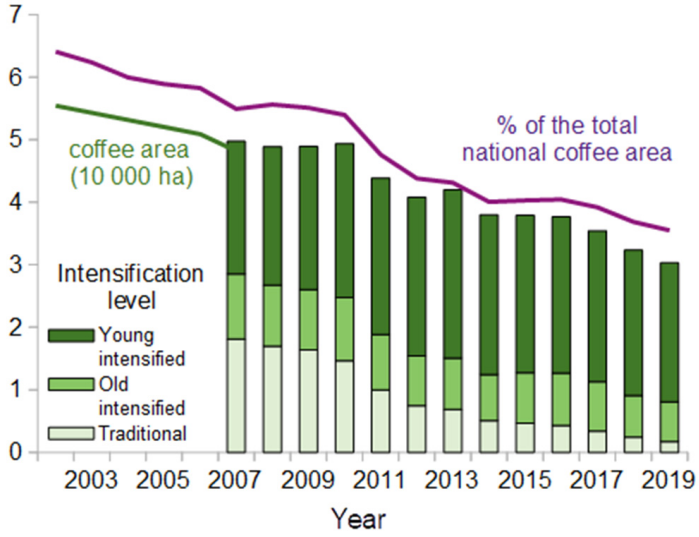

Figure 4. Changes in the relative and total coffee area in Cundinamarca between 2002 and 2019. Classes of intensification levels: (i) young intensified coffee with rust-resistant varieties and with less than 9–12 years of being planted; (ii) old intensified coffee with rust-resistant varieties but older than 9–12 years and mid/high densities (≥2500 coffee trees per ha); (iii) traditional coffee varieties with low planting densities (<2500 coffee trees per ha). Source: FNCC https://federaciondecafeteros.org/wp/estadisticas-cafeteras/ (accessed on 5 February 2020).

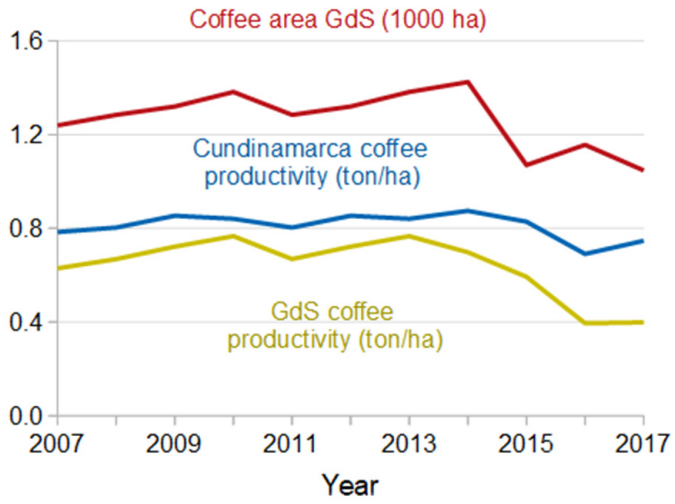

Figure 5. Changes in the total coffee area in GdS and productivity (total harvested area/total production) for Cundinamarca and GdS. Source: EVA https://www.datos.gov.co/Agricultura-y-Desarrollo-Rural/Evaluaciones-Agropecuarias-Municipales-EVA/2pnw-mmge (accessed on 30 January 2020).

Changes in coffee prices and the monthly fluctuations in the domestic market were evident and reflected the continuous variations in both the global market price and the value of the COP against the USD (Figure 6). This price oscillation indicated a high variability in the potential economic benefits of coffee production. The potential impact of this variability also depends on the synchronicity of high coffee prices during the harvest season and the capital needs of farmers. For example, although coffee prices during the harvest season in the study area (April to June) were relatively high in 2014 and 2018, they were relatively low between 2015 and 2017, and in 2019. The combination of high economic variability and environmental uncertainty can pose a risk to farmers whose livelihood largely depends on coffee production.

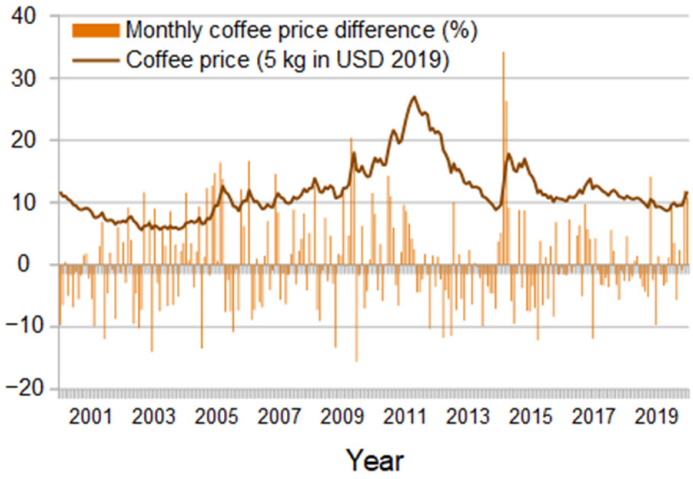

Figure 6. Changes in coffee price and monthly price difference of the internal market in USD between 2000 and 2019. Source FNCC https://federaciondecafeteros.org/wp/estadisticas-cafeteras/ (accessed on 5 February 2020).

3.2. Land Use in Guayabal de Síquima

Analysis of the agricultural data from the census at the village level revealed the overall structure of land use and farming in the study area (Table 1). The agricultural census did not cover the total area of the municipality, including three quarters of each village, except for Trinidad, which covered less than half of the area. Most of the reported land (91%) and farms (75%) were agricultural holdings. This pattern was less evident in

some villages (i.e., Centro, Mesitas, Pueblo Viejo, Resguardo, and Robledal), where almost a quarter of the farms had no agricultural activity, indicating a process of deagrarianisation and rurbanisation. The census data also showed that a large portion of farms, i.e., 63%, were smallholdings smaller than 2 ha. These smallholdings also dominated (>80%) the small villages of Centro, Mesitas, Resguardo, and Robledal. One third of the farms with intensive poultry production were in a single village (Mesitas), whereas other villages (El Trigo, Picacho, and Resguardo) reported none. Similarly, cattle production was also concentrated only in few villages. Almost a third of the reported cattle production was concentrated in El Trigo. Centro, Manoa, Resguardo, and Torres reported low numbers and density of cattle.

Table 1. Main land use and population characteristics per village. Source: DANE agricultural census data 2014.

Village	Reported Area *	Share of Tot. Area **	Agric. Area ***	Farms	Agric. Farms ***	Farms < 2 ha	Chicken Farms	Cattle Herd	Cattle Density
	%	%	%	No.	%	%	No.	No.	No./ha GRASSLAND
Centro	100	2	79	178	56	90	2	28	0.91
Chiniata	89	10	99	199	93	55	1	294	1.78
El Trigo	73	14	98	236	94	50	0	666	2.14
Manoa	76	15	80	154	75	39	4	99	0.76
Mesitas	77	4	79	297	49	83	11	172	3.64
Pajonal	87	11	98	183	93	48	1	308	2.63
Picacho	95	7	94	110	75	62	0	281	2.36
Pueblo Viejo	94	16	90	340	70	64	6	195	0.80
Resguardo	97	2	83	112	63	83	0	9	0.50
Robledal	86	2	93	138	67	84	2	116	2.18
Torres	88	11	96	133	91	59	1	6	0.12
Trinidad	43	4	93	98	83	69	5	69	1.44
Total	81	98	91	2178	75	63	33	2243	1.68

* Reported agricultural area compared to the total area of each village. ** It does not add up to 100% because it does not include urban centres. *** Reported any agricultural activity.

The census data also showed that the study area was characterised by multiple uses and covers, including cropland (coffee, sugar cane, plantain, banana, maize, papaya, avocado), grassland, small patches of forests, and other covers/uses such as fallow lands and secondary vegetation (Figure 7a). Villages with a higher altitude and a relatively larger proportion of grassland, such as El Trigo and Picacho, also had higher cattle densities, whereas most of the agricultural land in Torres was at a lower altitude and dominated by sugar cane production. Other covers and uses in some villages reached up to a third of the surveyed agricultural area. Furthermore, reported forested areas covered only 3% of the farmland, suggesting a high level of landscape transformation.

The data analysis also showed that, despite not being part of the main coffee-growing regions of the country for decades, coffee was still part of the landscape structure and farm production in the study area (Figure 7b). Coffee plantations covered 15% of the total surveyed area, reaching more than 20% of the land in some villages, while being limited in villages with more marginal agroecological conditions to produce coffee at predominantly higher altitudes (such as El Trigo with prevalent dairy and maize production) and lower altitudes (such as Torres with prevalent raw sugar production). Similarly, villages with more suitable agroecological conditions (such as Resguardo, Mesitas, and Pueblo Viejo) had relatively more (>47%) coffee farms compared to villages at a lower altitude (such as Manoa and Chiniata (30%), where sugar, cane, and maize were also dominant crops.

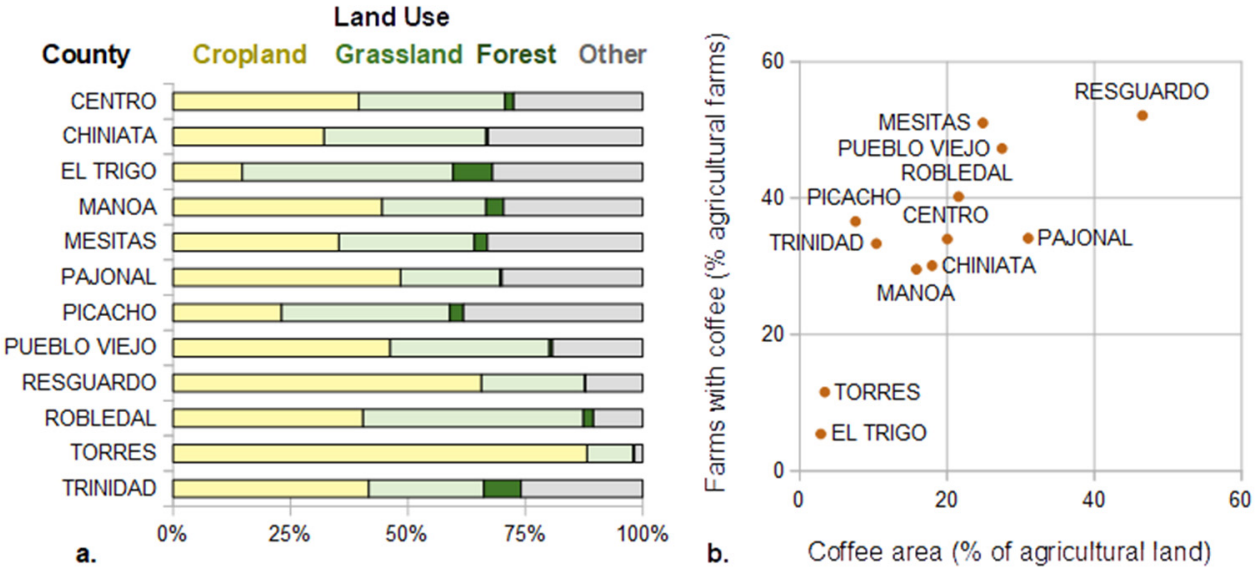

Figure 7. (**a**) Land use and (**b**) spatial distribution of coffee farmers and coffee areas in the different villages in the study area. Source: DANE agricultural census data 2014.

3.3. Coffee Farming in Guayabal de Síquima: Agricultural Census Data

Agricultural census data analysis provided further details on coffee farming in the study area (Table 2). In 2014, a quarter of the farmers were still producing coffee. Although only 53% of these farmers reported their age in the census, these data suggest that household heads over 60 years old managed almost half of the coffee farms, particularly in villages with fewer coffee farmers, such as Centro, El Trigo, Picacho, Robledal, and Trinidad. Additionally, the data show that a large part (68%) of the coffee farmers were smallholders, and half of all coffee farmers relied on family labour, reaching more than 60% of all the coffee farms in Mesitas, Robledal, and Trinidad. Coffee plantations still covered more than three quarters of the farm in many of these holdings and were often associated with other crops such as plantain, banana, and other fruit trees. Some coffee farmers also had poultry production (15%) and managed pigs and/or cattle (18%). Finally, one third of the coffee farmers reported drought problems in 2013, particularly in Pueblo Viejo, Resguardo, and Pajonal.

Table 2. Average land use data and socio-economic data by strata per selected coffee farms. Source: DANE agricultural census data 2014.

Village	Coffee Farmers	Farmers > 60 yrs *	Farms < 2 ha	Fam Labour > 50%	Coffee > 75% Area	Coffee Associated	Chickens	Pork and Cattle	Drought Problems
	No.	%	%	%	%	%	%	%	%
Centro	32	58	88	53	63	72	13	16	13
Chiniata	56	19	63	46	80	93	5	20	36
El Trigo	12	67	42	50	75	100	42	42	17
Manoa	34	57	44	15	91	91	18	18	35
Mesitas	72	46	89	65	76	58	14	17	28
Pajonal	57	34	39	44	61	68	18	32	40
Picacho	29	64	76	45	83	76	14	28	38
Pueblo Viejo	113	46	66	42	81	76	19	14	48
Resguardo	37	44	78	51	89	81	5	11	43
Robledal	37	67	86	62	78	73	8	5	35
Torres	14	14	57	7	50	93	14	0	14
Trinidad	26	64	73	62	73	96	31	35	38
Total	519	47	68	47	77	77	15	18	36

* Data available only for 53% of the surveyed farms.

3.4. Coffee Farming in Guayabal de Síquima: Interviews with Farmers

The farmers interviewed for this study differed in terms of their background and available resources (see Table 3). Almost half of the interviewees were over 60 years old. Household sizes ranged between one and five members and farm surface area ranged between 0.3 and 8.3 hectares. Almost half of the local coffee farmers and the majority of the other respondents reported off-farm income. In comparison to the other respondents, local coffee farmers indicated more food self-sufficiency due to their own food production. Nevertheless, they purchased additional food and goods in the neighbouring and cheaper large urban centres (such as Facatativá and Bogotá), instead of buying in the local shops. More than half of the interviewees said that they had a small poultry production for both their own consumption and for sale.

Table 3. Average land use and socio-economic data. Source: farmer interviews.

Variable	Unit	Categories		
		Local Coffee Farmers	**Migrant Coffee Farmers**	**Former Coffee Farmers**
Interviewees	**No.**	**11**	**6**	**6**
More than 60 years old	%	55	50	33
Household members	people	2.3 ± 0.8	2.8 ± 1.5	2.7 ± 1.2
Farm size	ha	3.1 ± 1.3	3.5 ± 1.8	4.4 ± 2.7 *
With off-farm income	%	46	100	83
Amount of food produced on farm	%	40	24	36 *
Purchasing goods in city	%	90	100	n.a.
Poultry production	%	55	83	83
Technical support	%	27	17	n.a.
Member of the FNCC	%	73	33	n.a.
Coffee area	% area	64 ± 28	49 ± 22	50 ± 28
Coffee income	% income	37 ± 30	18 ± 10	n.a.
Organic production	%	18	50	n.a.
Improved varieties	%	90	67	n.a.
Shaded coffee	% area	79 ± 34	58 ± 49	n.a.
Direct coffee selling	%	45	50	n.a.
Part unprocessed selling	%	36	33	n.a.

n.a.: not applicable. * Included only five households keeping their farms.

In terms of coffee production, three quarters of the local coffee farmers belonged to the FNCC. However, less than a quarter reported receiving any technical support on their farms. Compared to migrant farmers, local coffee farmers reported managing relatively larger areas of coffee with improved varieties under agroforestry systems (with shade) and obtaining a higher proportion of their income from selling coffee. Out of the five organic coffee farmers, only two used organic fertilisers to increase production, and only one had a certification in organic production. In fact, they mentioned that there was an organic farming association, but it collapsed due to the lack of trust and power imbalances among its members. Lastly, about half of the coffee farmers reported that they had the capacity to invest and sell processed coffee to family and friends, often based in Bogotá.

Looking at the constraints reported on coffee production, 75% of coffee farmers indicated that high input costs and low coffee prices were their main constraints. Other issues mentioned included the lack of affordable and competent labour, poor technical support, variable weather conditions (i.e., lack of rain or alternative water sources when needed, or excessive humidity to dry coffee beans under the sun), and the disproportionately advantageous role of intermediaries. The constraints of high production costs and low coffee prices were the main reasons why all the former coffee farmers had abandoned coffee and changed their production systems. In fact, a third of the coffee farmers had to sell their beans cheaply because they were either still on the tree or had not been dried well yet. In this way, farmers could obtain some cash needed to pay their expenses, losing on their

investment but saving time and labour. Finally, former coffee farmers replaced their entire coffee plantation with grassland and annual crops, and were not willing to produce coffee again within the current context. They all agreed that their quality of life had improved after leaving coffee production behind.

The farmers interviewed differed in their perceptions of farming and land use in the municipality (Figure 8). Most of them agreed that they would remain (coffee) farmers, that chemical fertilisers were good to increase coffee production, and that they would be interested in becoming organic farmers if they were given technical support. Most of them disagreed that fewer trees meant better agricultural production, that non-productive areas were of no use, and that it was better not to be associated with other farmers. Their perception regarding the remaining statements was more diverse. Specifically, some of them responded that the FNCC is an important organisation to support coffee production, few of them preferred their children working on the farm, some of them found that chemical pesticides are beneficial, and a third of them prioritised coffee quantity over quality. Lastly, some farmers were ambivalent in a few of their statements, specifically those concerning benefits of the intensive poultry production for the region ("*it generates jobs but pollutes the environment and damages the roads*") and those concerning the role of trees in agricultural production ("*too few trees are not desired, but too many trees tend to decrease coffee production*").

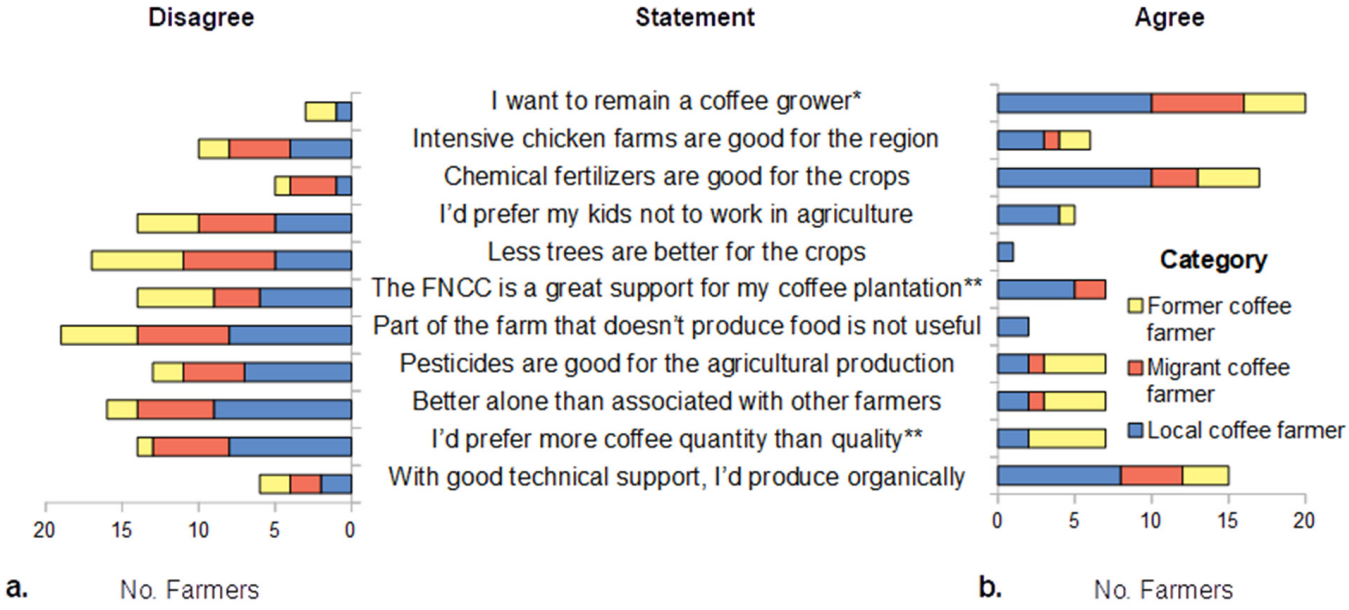

Figure 8. Number of (former) coffee farmers who (**a**) disagreed or (**b**) agreed with each statement. * Replaced by "farmer" for the former coffee farmers. ** When the former coffee farmers still grew coffee. Source: farmer interviews.

3.5. Current Rural Processes: Perceptions and Opportunities for Local Actors

The local actors interviewed indicated that the ongoing rural processes in the study area would continue (Figure 9a). Initially, they expected migration to cities to continue because of the limited economic opportunities for young people in the countryside. They also considered that more city dwellers would continue buying farms in their search for quality of life and/or leisure. This dichotomy of in- and out-migration was summarised by an interviewee as follows: "*The citizens are tired from the city and the villagers are tired from the countryside*".

Interviewees also agreed that local farmers were too old or too tired to continue farming. For example, as one farmer stated, "The old generations are disappearing, and their heirs are simply selling the land to people coming from the city for recreational purposes". They also believed that less water would be available in the near future due to decreased supply and increased demand. The complexity of this process was described by an interviewee as follows: "There will be less water available because of resource mismanagement, increasing demand, climate change and more pollution". In contrast, few

interviewees thought that intensive poultry farms would remain the same because of the current regulation or because those farms are not located in their villages. Similarly, only a few of them considered that coffee production would remain the same because it is already absent in their village. Lastly, most interviewees anticipated that current regulations would not effectively limit deforestation in the region in terms of the current reduction in the coffee area and increased grassland and urbanisation.

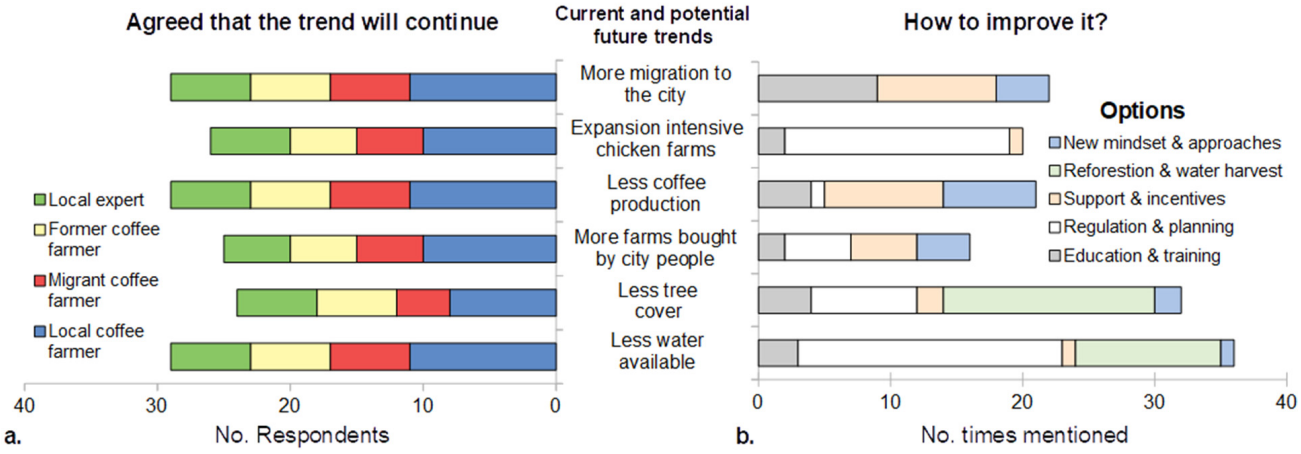

Figure 9. Interviewees' opinions: (**a**) agreement on current and future trends (only one option per respondent), and (**b**) possible options for improvement (more than one option per respondent). Source: farmer interviews.

The interviewees proposed different alternatives to better orient the current rural processes (Figure 9b). To limit migration to the city, allow for a generational turnover in family farming, and keep the agricultural sector alive in the municipality, respondents suggested multiple options, such as combining education, better training, government support, credits, and other economic incentives to improve the local social and economic options of young adults in agricultural production, processing, marketing, and agritourism. For example, as one interviewee mentioned, "*There is a need to create training programmes to support young farmers to come back and to use the land sustainably*".

In relation to intensive poultry production, interviewees mentioned the need for measures to ensure compliance with (sometimes existing) regulation and planning, as essential mechanisms to limit and/or spatially concentrate its expansion while reducing its negative impact (i.e., air and water pollution, road damage). They also indicated that besides technical advice and economic incentives to support coffee farmers (e.g., subsidies, better and stable coffee prices, lower input costs, FNCC programmes for smallholders), they needed new and related approaches, including changing the vision of the farm towards a family business, combining agricultural and non-agricultural activities (e.g., agritourism and catering), switching to varieties (old and/or new) different than those promoted by the FNCC, and (continuing) selling directly to consumers (i.e., more investment in coffee quality, processing, and marketing). A local expert referred to this as "*a need for empowering farmers to organise and manage their farm as a business, searching new specialized coffee markets, . . . and fostering a sense of belonging to the land and the region*".

The issue of city dwellers buying farms for (hobby) agricultural production and leisure was more controversial. Some respondents saw this as a threat to the agrarian/rural identity of the region, requiring strong regulation and/or education of newcomers regarding food production, garbage/noise pollution, and deforestation. In contrast, other respondents (including those who were migrants) perceived it as an alternative to improve quality of life and provide new sources of innovation and economic opportunities, including tourism and other services (e.g., computer and Internet services). Yet some interviewees recognised some of the trade-offs: "*People from the cities will demand more water, but at the same they can provide new jobs for the local population*". Finally, they mentioned more options to increase tree cover, biodiversity, and water availability/use, including land use planning,

strict regulations on tree cover protection along water bodies, reforestation programmes (including multipurpose trees) and incentives, and the design of innovative policies that benefit both tree cover increases and future use. For example, as one interviewee mentioned, "*Land use planning in the municipality should be based on water availability, while aiming at restoring key watersheds for improved water quantity and quality*".

4. Discussion

To contextualise and understand current trajectories, the rural processes and the dynamics identified for the study area are compared to other rural landscapes and coffee-growing regions in Latin America. Subsequently, potential options identified by local actors to better support and guide the future trajectories of the region are discussed.

4.1. Dynamics of Rural Processes

The results of this study illustrate the need for more integrated territorial approaches that account for multiple interacting rural processes. Regarding the challenges and opportunities of the increasing rurbanisation and in-/out-migration observed in the study area (i.e., urban–rural nexus), Berdegué et al. [9] explained how most rurality in Latin America is now located between highly urbanised centres and remote rural regions. In this now-dominant rurality, ensuring more integrated and inclusive urban–rural linkages (e.g., city region food systems, decent job opportunities for youth) is essential for the sustainable development and trajectories of rural regions in Latin America and elsewhere [9,33]. Likewise, related to the youth migration and rural population aging described in the study area, Wong and Palloni [34] showed that many regions in Latin America are facing similar challenges, with the fastest aging rate in the world driven by urbanisation processes, (youth) migration, changes in health and education, declining fertility rates, and increasing life expectancy, among others [35,36]. Furthermore, the identified processes of rural deagrarianisation and increased pluriactivity of households (both agricultural and non-agricultural) in this study have also been reported in other regions in Latin America as an important response of family farmers to an agricultural system in crisis and/or the emergence of new labour and market opportunities [37–43], reaffirming the multifunctionality of rural landscapes across the region and the need for more integrated landscape management initiatives [44,45].

Similarly, the processes of rurbanisation and farm fragmentation described in the study area are shaping the land use in many rural regions, particularly for those close to large urban centres. Gómez-Contreras [46] described how increased connectivity and/or proximity together with the expansion of urban demand for second homes have increased land prices and reinforced rurbanisation processes around Bogotá and even throughout Cundinamarca, where the study site is located. A consequence of these rural processes is that a substantial increase in land prices can marginalise local communities, limit traditional agricultural activities, and reinforce processes of deagrarianisation [47]. In contrast, the growing demand within the regions and from major urban centres for specific commodities (e.g., poultry and dairy production) has facilitated the intensification of agricultural production of those specific commodities, bringing new economic opportunities but also additional environmental challenges in dynamic and better-connected rural regions [48–50]. Finally, the lack of clear regulations and adequate governance has often led to unsustainable trajectories in many rural regions because of increased demand for limited resources (particularly land and water), environmental pollution (e.g., water pollution, garbage disposal, and pesticide misuse), and reduced tree cover across the landscape [17,48,51–53]. Given the limited spatial extent of this research, future studies could analyse more and/or contrasting case studies to confirm and provide a more detailed analysis on the synergies and trade-offs between different rural processes.

4.2. Main Dynamics of Small-Scale Coffee Farmers

In the case of coffee production, the results of this study also show the diversity of the rural households and land use systems within these regions. Although the study area

has not been part of the main coffee production regions in Colombia for decades [54], it continues to share similar dynamics to coffee farmers and landscapes elsewhere. On the one hand, changes in land use/cover for the study area can be placed in a more general trajectory of many coffee-growing regions that includes three main stages: coffee expansion, intensification, and abandonment [55]. Firstly, coffee is introduced and expanded, often causing the transformation of forested areas to agroforestry systems [20,27]. Secondly, coffee intensification is promoted due to the interaction of global demand, large price fluctuations, and national policies within a narrowed paradigm of merely economic profit, causing a replacement of many of these diverse multi-strata agroforestry systems by simple and denser coffee plantations with a few scattered (fruit) trees [8,55–58]. Lastly, coffee production is abandoned or replaced due to low and unstable profit margins, reduced access to (affordable) labour, limited institutional support, climate variability/change, and/or the emergence of alternative agricultural/labour markets [6,21,59–61].

On the other hand, Harvey et al. [12] described seven major land use trends in coffee-growing regions in Latin America, including the conversion to rust-resistant varieties, the conventional intensification of coffee production, the conversion of coffee plantations to other agricultural uses, and the urbanisation of coffee landscapes. Although the study area as a whole may be abandoning coffee production, as mentioned by Perfecto et al. [55], and/or could be described as a mixed of trends identified by Harvey et al. [12], the results of this study also show that the stages can be seen as different trajectories of individual coffee farms, where some farmers continue to produce coffee in agroforestry systems, others have intensified and simplified their coffee systems to achieve a higher productivity, and still other farmers have replaced or abandoned production.

Likewise, this study also identifies some key differences in livelihood strategies among farmers that often define their future trajectories and that are also found in other coffee-growing regions [62–65]. For example, farmers with a direct connection to the consumer had the economic incentive to maintain agroforestry systems and invest in improving the processing and quality of the coffee. Farmers who worked closely with the FNCC intensified their production through better access to technical support and incentives. Farmers who came from or had a strong connection to the cities often had access to some non-agricultural income, relying on coffee production as an alternative (economic) activity. Given the reduced number of farmers interviewed, a next research step would be to confirm and better understand the diversity in the trajectories of households, farms, and agroecosystems to identify more targeted options.

Specifically, the abandonment of coffee production is related to the vicious circle (as observed by some interviewees) of low profit, lack of timely capital, limited investment in coffee quality, low coffee prices, and even lower profit, which is also common for many smallholders in other coffee landscapes [14]. A possible alternative to break this circle is the implementation of social and ecological certification schemes that compensate farmers for improved quality of the product and more sustainable landscape management [60,66,67]. However, as evidenced by the example of the failed organic certification association in the study area, these instruments need to be carefully designed to support both rural livelihoods and the environment [54,64,68,69]. For example, Guhl [70] found that although the implementation of a scheme in another coffee-growing area in Colombia seemed profitable for the farmers and good for the environment, it mainly benefited better endowed farmers, excluding smallholders. To avoid this, the design of certification schemes needs to avoid high transaction costs, uneven distribution of additional value created, and burdensome requirements for smallholders [54,67,70]. However, given the underlying rural processes and drivers that influence the trajectories of coffee-growing regions, the findings of this study suggest that certification schemes are promising tools that should be part of a broader integrated approach to ensure that their expected impact promotes more inclusive and sustainable development [71,72].

This study also illustrates how farmers make use of short supply chains to partly break the vicious circle mentioned above. Specifically, the combination of a stronger urban–

rural nexus, including urban personal connections and a local demand for higher quality coffee, enabled some smallholders to shorten the supply chain and access a relatively more profitable, informal, but limited direct market for processed coffee beans. However, the direct selling of the interviewed farmers was very informal and it was not part of some of the more structured territorial short food chains described for the region by Reina-Usuga et al. [73]. Moreover, the added value in coffee supply chains is often linked to the export markets, but as Rueda and Lambin [54] described, the institutional support for improving coffee quality in the country is concentrated in other regions, where coffee has distinctive cup profiles. The future, scale, and sustainability of these short supply chains would largely depend on the consumer's preferences and demand [70]. This indicates that more institutional and technical support is needed to empower farmers and facilitate their access to the territorial supply chains.

Another important dynamic is related to the aging population described above. The lack of generational continuity in farming represents a challenge in the future trajectories of many coffee landscapes, even though coffee farmers are proud of their identity and prefer for their children to continue working the land. This lack of generational continuity indicates that if current social, institutional, and economic conditions do not change, many young and often educated (potential) smallholders will continue migrating to the cities, leaving coffee and even farming behind because working the land is not profitable and/or is a hard livelihood [21,74–77]. Although this study highlights the interactions of some major rural processes in coffee-growing regions, future research comparing more cases or including more actors could further examine the trade-offs and synergies of these interactions and what kinds of policies or programmes could foster more sustainable trajectories [12].

4.3. Potential Options to Improve Current Trajectories

The data analysis and interviews with local actors reinforced the call for more integrated and inclusive approaches. For instance, the empowerment of and support for family farming would need a combination of different programmes and instruments, such as economic and technical support, incentives (e.g., microcredits), and education and/or training by the local authorities (the National Training Centre (SENA) and the National Centre for Research on Coffee (Cenicafé, part of the FNCC)), among others. These incentives and programmes should continue to target potential young farmers to stay in rural areas working the land while limiting their permanent migration to the cities and the ongoing deagrarianisation of the region [21,78]. Besides improving their own technical skills and infrastructure, these programmes and incentives should also enable (young) farmers to invest and diversify their land use and labour activities into more profitable and sustainable agricultural and non-agricultural businesses, including coffee quality improvement, direct product sales, processing of agricultural products, and/or agritourism, among others. As suggested by many respondents, this empowerment could be fostered within strengthened and functional farmer cooperatives, as also mentioned in similar studies [78–81].

Inclusive and integrated landscape management approaches are also a main tool to support sustainable trajectories in the region [82]. On the one hand, as in many other rural regions, clear regulations and land use planning that address local needs are essential for comprehensive development of the study area. For example, although local and environmental authorities have restricted the expansion of the industrialised poultry production, it is necessary to concentrate it in a few locations, limiting and facilitating the mitigation of its potential externalities (e.g., water and air pollution, road damages) while ensuring some local jobs and economic revenue. Similarly, based on such a comprehensive land use plan, local authorities could better guide and regulate ongoing processes of rurbanisation, deforestation, and watershed degradation. This could also include the use of incentives and certification programmes to make the production of shade and higher-quality coffee less risky and more profitable in the region, persuading and supporting

smallholders to invest, maintain, and/or restore agroforestry production systems and to limit the use of chemical inputs [51,70].

On the other hand, inclusive landscape restoration and sustainable land use processes, as well as educational programmes led by regional environmental authorities (Corporación Autónoma Regional), could also be reinforced throughout the region to consolidate the sustainable use, protection, and/or ecological restoration of priority watersheds and ecosystems. In fact, as Hernández-Peña [83] argued, many of the environmental challenges in these rural regions need to be addressed at a more regional scale by these environmental authorities, while being aligned and/or guiding national and local plans. Further research could consider a broader analysis of the study region with local actors, including the food system as a whole and the construction of a common future vision and scenarios while analysing key trade-offs among prioritised sustainability goals for the entire region [84]. Given the socio-economic and climatic uncertainties in the medium-/long-term viability of coffee [15], this exploration should also consider the potential livelihood and land use alternatives of a future without coffee in the region, while ensuring the provision of key ecosystem services.

However, as indicated by Daniels and Petchers [14], supporting family farming and implementing effective regulations are only possible within an enabling and trustworthy local, national, and global institutional context. Specifically, given the central role of the FNCC in promoting and assisting coffee farmers, few respondents felt that it was supporting them. This perception aligns with other studies, suggesting that the FNCC, regional environmental authorities, and similar organisations across these rural regions could provide better and more comprehensive support to a broader range of coffee farmers and other rural actors [83,85,86]. Additionally, a more structured programme with producer and consumer associations, and other local and regional public and private institutions could aim at strengthening and promoting the region as a sustainable rural landscape, supporting family farmers and local entrepreneurs to invest and transition to family businesses by taking advantage of the growing urban–rural nexus (e.g., sustainable tourism and recreation) and the agricultural identity of the region, and demanding better-quality and -processed coffee, poultry, dairy, and other food products; shortening the food supply chain; and obtaining a fairer income for their products [87]. Further analysis of the institutional context and agricultural value-added chains could better inform local policies and programmes to promote more sustainable and profitable agricultural practices.

5. Conclusions

The aim of this paper was to illustrate the interaction between rural processes and their drivers in a municipality in Colombia, and to contextualise the perceptions of local actors on the main constraints and opportunities for fostering more sustainable rural landscapes. The analysis of the main drivers, land use, and coffee farm structure, as well as interviews with different actors, allowed us to picture a general overview of the current rural processes and potential future options in the study area. These analyses showed the diversity of the rural households and land use systems within these regions. The multiplicity of interacting actors, food/land use systems, rural dynamics, and drivers described in this study confirm the need for inclusive, integrated, and transformative landscape planning approaches for the sustainable development of rural regions that align with (local) actor priorities [4,7,17,52,88,89]. Although these findings support the results of other studies in similar regions across Latin America, future research could include more and diverse regions, and/or more interviews with local actors to confirm these findings and to develop more specific options for the study area or similar regions.

Nevertheless, integrated territorial approaches must be accompanied by changes at a more systemic level that can address the fundamental bottlenecks to truly sustainable transformation in food and land use systems, including reconnecting people with nature, restructuring institutions, and rethinking knowledge creation and use [90,91]. Some interviewees referred to this as a "*change in consciousness*", where rather than looking at simply

narrow, short-term, and exclusive economic benefits, the rural trajectory of the region must be based on an inclusive, integrated, and long-term vision for quality of life.

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Data Availability Statement: Publicly datasets analysed during this study included: National Bank exchange rate (https://www.banrep.gov.co, accessed on 10 February 2020); historical monthly Consumer Price Index (https://federaciondecafeteros.org/wp/estadisticas-cafeteras/, accessed on 5 February 2020); local population data (https://www.dane.gov.co/files/censo2018/informacion-tecnica/CNPV-2018-Poblacion-Ajustada-por-Cobertura.xls, accessed on 21 January 2020); farm size data (http://www.cundinamarca.gov.co/Home/SecretariasEntidades.gc/Secretariadeplaneacion/SecretariadeplaneacionDespliegue/asestadisticas_contenidos/csecreplanea_estadis_anuario, accessed on 30 January 2020); land use data (https://www.datos.gov.co/Agricultura-y-Desarrollo-Rural/Evaluaciones-Agropecuarias-Municipales-EVA/2pnw-mmge, accessed on 30 January 2020).

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References

1. Guimarães, R.P. Desarrollo Sustentable: ¿Todavía Esperando a Godot? *Terra* **2015**, *1*, 67–98.
2. Ayram, C.A.C.; Etter, A.; Díaz-Timoté, J.; Buriticá, S.R.; Ramírez, W.; Corzo, G. Spatiotemporal evaluation of the human footprint in Colombia: Four decades of anthropic impact in highly biodiverse ecosystems. *Ecol. Indic.* **2020**, *117*, 106630. [CrossRef]
3. Grau, H.R.; Aide, M. Globalization and land-use transitions in Latin America. *Ecol. Soc.* **2008**, *13*, 16. [CrossRef]
4. Boillat, S.; Scarpa, F.M.; Robson, J.P.; Gasparri, N.I.; Aide, T.M.; Aguiar, A.P.; Anderson, L.O.; Batistella, M.; Fonseca, M.; Futemma, C.; et al. Land system science in Latin America: Challenges and perspectives. *Curr. Opin. Environ. Sustain.* **2017**, *26*, 37–46. [CrossRef]
5. Carr, D.L.; Lopez, A.C.; Bilsborrow, R.E. The population, agriculture, and environment nexus in Latin America: Country-level evidence from the latter half of the twentieth century. *Popul. Environ.* **2009**, *30*, 222–246. [CrossRef]
6. Ribeiro Palacios, M.; Huber-Sannwald, E.; García Barrios, L.; Peña de Paz, F.; Carrera Hernández, J.; de Guadelupe Galindo Mendoza, M. Landscape diversity in a rural territory: Emerging land use mosaics coupled to livelihood diversification. *Land Use Policy* **2013**, *30*, 814–824. [CrossRef]
7. Zimmerer, K.S.; Lambin, E.F.; Vanek, S.J. Smallholder telecoupling and potential sustainability. *Ecol. Soc.* **2018**, *23*, 30. [CrossRef]
8. Rice, R.A. A place unbecoming: The coffee farm of northern Latin America. *Geogr. Rev.* **1999**, *89*, 554–579. [CrossRef] [PubMed]
9. Berdegué, P.J.A.; Bebbington, A.; Escobal, J.; Favareto, A.; Fernández, M.I.; Ospina, P. *Territorios en Movimiento Dinámicas Territoriales Rurales en América Latina (Territories in Movement Rural Territorial Dynamics in Latin America)*; Working Paper 110; Programa Dinámicas Territoriales Rurales-Rimisp: Santiago, Chile, 2012.
10. Dobbs, C.; Escobedo, F.J.; Clerici, N.; de la Barrera, F.; Eleuterio, A.A.; MacGregor-Fors, I.; Reyes-Paecke, S.; Vásquez, A.; Camaño, J.D.Z.; Hernández, H.J. Urban ecosystem Services in Latin America: Mismatch between global concepts and regional realities? *Urban Ecosyst.* **2019**, *22*, 173–187. [CrossRef]
11. Pauchard, A.; Barbosa, O. Regional assessment of Latin America: Rapid urban development and social economic inequity threaten biodiversity hotspots. In *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*; Springer: Dordrecht, The Netherlands, 2013; pp. 589–608.

12. Harvey, C.A.; Pritts, A.A.; Zwetsloot, M.J.; Jansen, K.; Pulleman, M.M.; Armbrecht, I.; Avelino, J.; Barrera, J.F.; Bunn, C.; García, J.H.; et al. Transformation of coffee-growing landscapes across Latin America. A review. *Agron. Sustain. Dev.* **2021**, *41*, 62. [CrossRef]
13. Perfecto, I.; Armbrecht, I.; Philpott, S.M.; Soto-Pinto, L.; Dietsch, T.V. *Shaded Coffee and the Stability of Rainforest Margins in Northern Latin America, in Stability of Tropical Rainforest Margins*; Springer: Berlin, Germany, 2007; pp. 225–261.
14. Daniels, S.; Petchers, S. The Coffee Crisis Continues; Oxfam America. 2005, p. 43. Available online: https://s3.amazonaws.com/oxfam-us/www/static/oa3/files/coffee-crisis-continues.pdf (accessed on 15 November 2021).
15. Ramirez-Villegas, J.; Salazar, M.; Jarvis, A.; Navarro-Racines, C.E. A way forward on adaptation to climate change in Colombian agriculture: Perspectives towards 2050. *Clim. Chang.* **2012**, *115*, 611–628. [CrossRef]
16. Bunn, C.; Läderach, P.; Rivera, O.O.; Kirschke, D. A bitter cup: Climate change profile of global production of Arabica and Robusta coffee. *Clim. Chang.* **2015**, *129*, 89–101. [CrossRef]
17. Perfecto, I.; Vandermeer, J. *Coffee Agroecology: A New Approach to Understanding Agricultural Biodiversity, Ecosystem Services and Sustainable Development*; Routledge: London, UK, 2015.
18. Jha, S.; Bacon, C.M.; Philpott, S.M.; Méndez, V.E.; Läderach, P.; Rice, R.A. Shade coffee: Update on a disappearing refuge for biodiversity. *BioScience* **2014**, *64*, 416–428. [CrossRef]
19. Jha, S.; Bacon, C.M.; Philpott, S.M.; Rice, R.A.; Méndez, V.E.; Läderach, P. A review of ecosystem services, farmer livelihoods, and value chains in shade coffee agroecosystems. In *Integrating Agriculture, Conservation and Ecotourism: Examples from the Field*; Springer: Dordrecht, The Netherlands, 2011; pp. 141–208. [CrossRef]
20. Guhl, A. Coffee production intensification and landscape change in Colombia, 1970–2002. In *Land-Change Science in the Tropics: Changing Agricultural Landscapes*; Millington, A., Jepson, W., Eds.; Springer: Boston, MA, USA, 2008; pp. 93–116.
21. Muñoz-Rios, L.A.; Vargas-Villegas, J.; Suarez, A. Local perceptions about rural abandonment drivers in the Colombian coffee region: Insights from the city of Manizales. *Land Use Policy* **2020**, *91*, 104361. [CrossRef]
22. FNCC. Pobreza y vulnerabilidad de los hogares cafeteros en Colombia. *Ens. Sobre Econ. Cafe.* **2016**, *32*, 67–84.
23. Cundinamarca, G.d.; FNCC. Café Cundinamarqués. *Rev. La Barra* **2015**, *18*, 6–7.
24. DANE. *Proyección de Población según Censo 2005 Para Los 116 Municipios de Cundinamarca por Zona (Urbano, Rural y Total)*; DANE: Bogotá, Colombia, 2017.
25. Bejarano, J.A. Los estudios sobre la historia del café en Colombia. *Cuad. De Econ.* **1980**, *1*, 115–140.
26. Acemoglu, D.; Bautista, M.A.; Querubín, P.; Robinson, J. Economic and Political Inequality in Development: The Case of Cundinamarca, Colombia; Working Paper Series; National Bureau of Economic Reseach: 2007. Available online: https://economics.mit.edu/files/3831 (accessed on 15 November 2021).
27. Palacios Rozo, M.A. *Coffee in Colombia, 1850–1970*; Cambridge University Press: Cambridge, UK, 1980; p. 338.
28. Machado, A. *El Café en Colombia a Principios Del Siglo XX, in Desarrollo Económico y Social en Colombia Siglo XX*; UNAL: Bogotá, Colombia, 2001; pp. 77–97.
29. Dube, O.; Vargas, J.F. *Resource Curse in Reverse: The Coffee Crisis and Armed Conflict in Colombia*; CEDE: Bogotá, Colombia, 2006.
30. Rettberg, A. Global markets, local conflict: Violence in the Colombian coffee region after the breakdown of the International Coffee Agreement. *Lat. Am. Perspect.* **2010**, *37*, 111–132. [CrossRef]
31. Córdoba, C.S. Otávaro.; F. Yepes. El consumo interno de café en Colombia: Medición y determinantes. *Ens. Sobre Econ. Cafe.* **2018**, *33*, 39–65.
32. Arboleda, M. Spaces of extraction, metropolitan explosions: Planetary urbanization and the commodity boom in Latin America. *Int. J. Urban Reg. Res.* **2016**, *40*, 96–112. [CrossRef]
33. Hussein, K.; Suttie, D. *IFAD RESEARCH SERIES 5-Rural-Urban Linkages and Food Systems in Sub-Saharan Africa: The Rural Dimension*; IFAD Research series; IFAD: Rome, Italy, 2016.
34. Wong, R.; Palloni, A. Aging in Mexico and Latin America. In *International Handbook of Population Aging*; Springer: Dordrecht, The Netherlands, 2009; pp. 231–252.
35. Brea, J.A. *Population Dynamics in Latin America*; Population Reference Bureau: Washington, DC, USA, 2003; Volume 58.
36. Cotlear, D. *Envejecimiento de la Población:¿ Está Preparada América Latina, in Envejecimiento de la Población*; World Bank: Washington, DC, USA, 2011; p. 278.
37. De Janvry, A.; Sadoulet, E. Rural poverty in Latin America: Determinants and exit paths. *Food Policy* **2000**, *25*, 389–409. [CrossRef]
38. Feltre, C.; Bacha, C.J.C. A evolução da pluriatividade nos estados de São Paulo e Pernambuco no período de 2001 a 2007. *Rev. Econômica Do Nordeste* **2010**, *41*, 41–56.
39. Hecht, S. The new rurality: Globalization, peasants and the paradoxes of landscapes. *Land Use Policy* **2010**, *27*, 161–169. [CrossRef]
40. Martin, C. Migraciones, pluriactividad y recomposición del espacio rural. Las dinámicas múltiples del sur boliviano. *Espacialidades* **2012**, *2*, Mexico.
41. Kay, C. The agrarian question and the neoliberal rural transformation in Latin America. *Eur. Rev. Lat. Am. Caribb. Stud./Rev. Eur. De Estud. Latinoam. Y Del Caribe* **2015**, 73–83. [CrossRef]
42. Sánchez Saldaña, K.; Saldaña Ramírez, A. Rural mobilities and agricultural work in morelos in the 21 st century. *Textual* **2019**, *2019*, 245–276. [CrossRef]
43. Anjos, F.S.d.; Caldas, N.V. Novos Dados Sobre a Evolução da População Ativa Rural e da Pluriatividade No Rio Grande do SUL. In Proceedings of the 46th Congress of the Sociedade Brasileira de Economia, Administracao e Sociologia Rural (SOBER), Rio Branco, Acre, Brazil, 20–23 July 2008.

44. Romero, J. Lo rural y la ruralidad en América Latina: Categorías conceptuales en debate. *Psicoperspectivas* **2012**, *11*, 8–31.
45. Estrada-Carmona, N.; Hart, A.K.; DeClerck, F.A.; Harvey, C.A.; Milder, J.C. Integrated landscape management for agriculture, rural livelihoods, and ecosystem conservation: An assessment of experience from Latin America and the Caribbean. *Landsc. Urban Plan.* **2014**, *129*, 1–11. [CrossRef]
46. Gómez Contreras, L.M. La segunda residencia: Espacios fragmentados e interconectados. *Perspect. Geográfica* **2010**, *15*, 113–124. [CrossRef]
47. Gascón, J.; Milano, C. Tourism, real estate development and depeasantisation in Latin America. *Eur. Rev. Lat. Am. Caribb. Stud./Rev. Eur. Estud. Lat. Caribe* **2018**, *2018*, 21–38. [CrossRef]
48. Torres Lima, P.; Sánchez, L.R. Dinámica agroambiental en áreas periurbanas de México: Los casos de Guadalajara y Distrito Federal. *Investig. Geográficas* **2006**, *60*, 62–82. [CrossRef]
49. Quinones, X.; Gálvez, D. Estimación y estructura de los ingresos de familias mapuches rurales de zonas periurbanas de Temuco, Chile: Estimation and structure of rural Mapuche families income in peri-urban areas of Temuco, Chile. *Mundo Agrar. [En Línea]* **2015**, *16*, 32.
50. Maraschio, G.; Fernanda, M.; Natalia, K.; María Florencia, M.; Gerardo Daniel, C. La Agricultura Familiar en un Territorio de Interfase Rural-Urbana: El Caso del Partido de Luján, PBA. In Proceedings of the Jornadas Platenses de Geografía y XX Jornadas de Investigación y de Enseñanza en Geografía, Plata, Argentina, 17–19 October 2018.
51. Swinton, S.M.; Escobar, G.; Reardon, T. Poverty and environment in Latin America: Concepts, evidence and policy implications. *World Dev.* **2003**, *31*, 1865–1872. [CrossRef]
52. Altieri, M.A.; Toledo, V.M. The agroecological revolution in Latin America: Rescuing nature, ensuring food sovereignty and empowering peasants. *J. Peasant Stud.* **2011**, *38*, 587–612. [CrossRef]
53. Carriquiriborde, P.; Mirabella, P.; Waichman, A.; Solomon, K.; Brink, P.J.V.D.; Maund, S. Aquatic risk assessment of pesticides in Latin America. *Integr. Environ. Assess. Manag.* **2014**, *10*, 539–542. [CrossRef]
54. Rueda, X.; Lambin, E.F. Responding to globalization: Impacts of certification on Colombian small-scale coffee growers. *Ecol. Soc.* **2013**, *18*, 21. [CrossRef]
55. Perfecto, I.; Jiménez-Soto, M.E.; Vandermeer, J. Coffee landscapes shaping the Anthropocene: Forced simplification on a complex agroecological landscape. *Curr. Anthropol.* **2019**, *60* (Suppl. S20), S236–S250. [CrossRef]
56. Watson, K.; Achinelli, M.L. Context and contingency: The coffee crisis for conventional small-scale coffee farmers in Brazil. *Geogr. J.* **2008**, *174*, 223–234. [CrossRef]
57. McCook, S. Environmental history of coffee in Latin America. In *Oxford Research Encyclopedia of Latin American History*; Oxford University Press: Oxford, UK, 2017.
58. Valencia, V.; García-Barrios, L.; Sterling, E.J.; West, P.; Meza-Jiménez, A.; Naeem, S. Smallholder response to environmental change: Impacts of coffee leaf rust in a forest frontier in Mexico. *Land Use Policy* **2018**, *79*, 463–474. [CrossRef]
59. Aide, T.M.; Grau, H.R. Globalization, Migration, and Latin American Ecosystems. *Science* **2004**, *305*, 1915–1916. [CrossRef] [PubMed]
60. Perfecto, I.; Vandermeer, J.; Mas, A.; Soto-Pinto, L. Biodiversity, yield, and shade coffee certification. *Ecol. Econ.* **2005**, *54*, 435–446. [CrossRef]
61. Murray, D.L.; Raynolds, L.T.; Taylor, P.L. The future of Fair Trade coffee: Dilemmas facing Latin America's small-scale producers. *Dev. Pract.* **2006**, *16*, 179–192. [CrossRef]
62. Agudelo, C.; Rivera, B.; Tapasco, J.; Estrada, R. Designing Policies to Reduce Rural Poverty and Environmental Degradation in a Hillside Zone of the Colombian Andes. *World Dev.* **2003**, *31*, 1921–1931. [CrossRef]
63. López, A.; Somarriba, E.; Bonilla, G. Tipologías y manejo de fincas cafetaleras en los municipios de San Ramón y Matagalpa, Nicaragua. *Agroforestería En Las Américas* **2003**, *10*, 74–79.
64. Bravo-Monroy, L.; Potts, S.G.; Tzanopoulos, J. Drivers influencing farmer decisions for adopting organic or conventional coffee management practices. *Food Policy* **2016**, *58*, 49–61. [CrossRef]
65. Bhattarai, S.; Alvarez, S.; Gary, C.; Rossing, W.; Tittonell, P.; Rapidel, B. Combining farm typology and yield gap analysis to identify major variables limiting yields in the highland coffee systems of Llano Bonito, Costa Rica. *Agric. Ecosyst. Environ.* **2017**, *243*, 132–142. [CrossRef]
66. Kilian, B.; Jones, C.; Pratt, L.; Villalobos, A. Is sustainable agriculture a viable strategy to improve farm income in Central America? A case study on coffee. *J. Bus. Res.* **2006**, *59*, 322–330. [CrossRef]
67. Bray, J.G.; Neilson, J. Reviewing the impacts of coffee certification programmes on smallholder livelihoods. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2017**, *13*, 216–232. [CrossRef]
68. Raynolds, L.T.; Murray, D.; Taylor, P.L. Fair trade coffee: Building producer capacity via global networks. *J. Int. Dev. J. Dev. Stud. Assoc.* **2004**, *16*, 1109–1121. [CrossRef]
69. Rueda, X.; Thomas, N.E.; Lambin, E.F. Eco-certification and coffee cultivation enhance tree cover and forest connectivity in the Colombian coffee landscapes. *Reg. Environ. Chang.* **2015**, *15*, 25–33. [CrossRef]
70. Guhl, A. Café, bosques y certificación agrícola en Aratoca, Santander. *Rev. De Estud. Soc.* **2009**, *32*, 114–125. [CrossRef]
71. Méndez, V.E.; Bacon, C.M.; Olson, M.; Petchers, S.; Herrador, D.; Carranza, C.; Trujillo, L.; Guadarrama-Zugasti, C.; Cordón, A.; Mendoza, A. Effects of Fair Trade and organic certifications on small-scale coffee farmer households in Central America and Mexico. *Renew. Agric. Food Syst.* **2010**, *25*, 236–251. [CrossRef]

72. Barham, B.L.; Callenes, M.; Gitter, S.; Lewis, J.; Weber, J. Fair trade/organic coffee, rural livelihoods, and the "agrarian question": Southern Mexican coffee families in transition. *World Dev.* **2011**, *39*, 134–145. [CrossRef]
73. Reina-Usuga, L.; de Haro-Giménez, T.; Parra-López, C. Food governance in territorial short food supply chains: Different narratives and strategies from Colombia and Spain. *J. Rural Stud.* **2020**, *75*, 237–247. [CrossRef]
74. López Cardona, L. Generación de relevo y decisiones de inversión en fincas cafeteras en el departamento de Caldas–Colombia. *Soc. Y Econ.* **2013**, *24*, 263–286.
75. Barbosa, W.G.J.; De La Portilla, E.; Basante, A.Y.; Zúñiga, L.A.; Zambrano, D.F.; Rojas, J.S.; Delgado, R.A. Relevo generacional para la continuidad de producción cafetera familiar. caso municipio de albán, nariño-colombia1. *Rev. Colomb. De Cienc. Soc.* **2018**, *10*, 67–92. [CrossRef]
76. Castro Lotero, A.D.; Correa, L.M.R. *La Vejez del Mejor Café Del Mundo*; Revistas CSP 224; Universidad Católica de Pereira: Pereira, Colombia, 2016; p. 29.
77. Escamilla-Prado, E. El relevo generacional en el sector cafetalero: La experiencia de los cursos de café para niños en Chocamán, Veracruz, México. *Agro Product.* **2018**, *11*, 48–54.
78. Velásquez-Rodríguez, C.; Payán-Durán, L. Organizational Model Design for Small Coffee Farmers in the Municipality of Viotá-Colombia Case Study: Creo en el Agro. *Syst. Pract. Action Res.* **2021**. [CrossRef]
79. Bacon, C.M. A spot of coffee in crisis: Nicaraguan smallholder cooperatives, fair trade networks, and gendered empowerment. *Lat. Am. Perspect.* **2010**, *37*, 50–71. [CrossRef]
80. Sánchez Bajo, C. Las cooperativas en las cadenas de valor del café en Guatemala: Su contribución al logro de objetivos sociales, laborales y ambientales. *Rev. Del Cent. De Estud. De Sociol. Del Trab. (CESOT)* **2016**, *8*, 35–74.
81. Vargas Prieto, A.; Guzmán, D.C.C. Efecto de las cooperativas exportadoras de café en el crecimiento de la economía solidaria en Colombia. *Revesco Rev. De Estud. Coop.* **2019**, *130*, 213–234. [CrossRef]
82. Sayer, J.; Sunderland, T.; Ghazoul, J.; Pfund, J.-L.; Sheil, D.; Meijaard, E.; Venter, M.; Boedhihartono, A.K.; Day, M.; Garcia, C.; et al. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *Proc. Natl. Acad. Sci. USA* **2013**, *110*, 8349–8356. [CrossRef]
83. Hernández Peña, Y.T. El ordenamiento territorial y su construcción social en Colombia:¿ un instrumento para el desarrollo sustentable? *Cuad. Geogr. Rev. Colomb. Geogr.* **2010**, *19*, 97–109. [CrossRef]
84. Walker, W.E.; Haasnoot, M.; Kwakkel, J.H. Adapt or perish: A review of planning approaches for adaptation under deep uncertainty. *Sustainability* **2013**, *5*, 955–979. [CrossRef]
85. Aguilar Zambrano, L.I. Crisis del café y el desarrollo regional. *Cuad. Econ.* **2003**, *22*, 239–272.
86. Rodríguez Padrón, B.; Burger, K. Diversification and labor market effects of the Mexican coffee crisis. *World Dev.* **2015**, *68*, 19–29. [CrossRef]
87. Berdegué, J.A.; Fuentealba, R. Latin America: The state of smallholders in agriculture. In Proceedings of the IFAD conference on New Directions for Smallholder Agriculture, Rome, Italy, 24–25 January 2011.
88. Benavente Cárdenas, C.; Camargo Salcedo, P.; Sarmiento Sarmiento, G.; Mena Chacón, L. Evaluación del desarrollo de la agricultura periurbana y propuesta de gestión integral en el distrito de Cayma, Arequipa, Perú. *Idesia* **2018**, *36*, 53–61. [CrossRef]
89. Albrechts, L.; Barbanente, A.; Monno, V. Practicing transformative planning: The territory-landscape plan as a catalyst for change. *City Territ. Arch.* **2020**, *7*, 1. [CrossRef]
90. Meadows, D.H. *Leverage Points: Places to Intervene in a System*; Sustainability Institute: Hartland, MI, USA, 1999; p. 18.
91. Abson, D.J.; Fischer, J.; Leventon, J.; Newig, J.; Schomerus, T.; Vilsmaier, U.; von Wehrden, H.; Abernethy, P.; Ives, C.D.; Jager, N.W.; et al. Leverage points for sustainability transformation. *Ambio* **2017**, *46*, 30–39. [CrossRef]