

## RESEARCH ARTICLE

# Influences of territorial conflicts on local crop diversity in a campesino community in the Colombian Caribbean

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Land and agrarian conflicts have intensified Colombia's internal war, particularly through land grabbing and dispossession, victimizing rural communities. National policies have favored industrial agriculture while marginalizing traditional smallholder practices. In the Colombian Caribbean region, this has hindered campesino livelihoods and biocultural memory. This research examines how agrarian conflicts have influenced agricultural practices and local crop diversity at the scale of a campesino community. It offers insights into the links between agrarian conflicts, transformations in local food systems, and the erosion of biocultural memory. Drawing on concepts from agrobiodiversity, biocultural memory, and political ecology, this study uses social mapping and historical analysis to assess how people experience spatiotemporal changes in land use and crop diversity. The findings show that people connect the decrease in crop diversity to wider changes in the food system, the effects of the violent agrarian conflict, and the expansion of industrial agriculture supported by the State.

**Keywords:** Agrarian history, Agrobiodiversity, Armed conflict, Land grabbing, Local knowledge, Local memory, Participatory science

## Introduction

In the global food trade, tropical countries have been ruled by the dictates of the capitalist agro-industrial model that prioritizes high yields through export-oriented production, disregarding the environmental and human consequences for the producing territories (Figueroa-Helland et al., 2018; Veltmeyer and Ezquerro-Cañete, 2023). This model has largely benefited large-scale transnational capitals while triggering environmental degradation, the loss of traditional farming practices, and the deterioration of the socioeconomic conditions of local communities (Patel, 2013; John and Babu, 2021; Borrás et al., 2024). Despite its promises to provide food security, agro-industrial production has accentuated land concentration and social-environmental conflicts (Chohan, 2024).

Additionally, industrial agriculture has been a main driver of the decrease in crop diversity (Zimmerer and de Haan, 2017). In recent decades, the cultivation of just a few edible plants in large-scale monocrops has replaced broad repertoires of local food-plant varieties and has resulted in dietary homogenization (Khoury et al., 2014). Market dynamics have privileged commercial varieties, causing the loss of crop genetic diversity on a global scale (Montenegro de Wit, 2016). Thus, local varieties have become underutilized and lost, together with many traditional practices and uses that linked farmers to food (Ray, 2023).

Biodiverse agricultural systems could be an alternative for designing fair and sustainable food systems that prioritize community well-being, nutritional sufficiency, and environmental sustainability (McIntyre et al., 2008; Frison et al., 2011; McGreevy et al., 2022). Indeed, local communities make daily use of plant diversity based on their particular needs and preferences, geographic availability, and traditional ecological knowledge (Jarvis et al., 2008; Antonelli, 2023). Agrobiodiversity results from the intersection of biological and cultural diversity in food and agriculture, and includes, on the one hand, the species and varieties of harvested, cultivated, and domesticated organisms, and on the other hand, the cultural, socioeconomic, and ecological components that sustain agricultural and food systems (Altieri, 1999). In a broad sense, agrobiodiversity describes the dynamics existing between

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the biophysical and social processes that compose food systems, and its analysis is necessary to understand and respond to global challenges, especially food and nutritional security, the conservation of biocultural diversity and sustainable development (Zimmerer et al., 2019). However, achieving highly agrobiodiverse systems not only depends on the willingness of farmers but also on multiple factors, such as the dynamics of global markets, the local biophysical, political and economic conditions, and land access (Zimmerer et al., 2021). In particular, there is a need to better understand the impacts of the trajectories of agrarian conflict and changes in agrobiodiversity (Chohan, 2024). In this study, we focus on the impacts of the Colombian internal armed conflict on crop diversity in a campesino community in the Caribbean region.

In Colombia, crop diversity has been influenced by the relationship between land and agrarian conflicts, and the country's internal war in recent decades<sup>1</sup> (Thomson, 2011). The Colombian armed conflict often benefited the expansion of agrarian capitalism by allowing land concentration through land grabbing and forced displacements, deeply victimizing rural communities (Counter, 2019). Agrarian elites, collaborating with public officials and right-wing paramilitary militias, accumulated land by violently dispossessing small-scale farmers (Navarrete-Cruz et al., 2023). Land concentration favored the expansion of large-scale industrial agriculture, homogenizing agricultural landscapes and hindering campesino<sup>2</sup> livelihoods. Landscape homogenization produced environmental degradation and decreased food security, while deepening social injustice and inequality (Vargas Reina and Uribe, 2017).

In this context, keeping a highly agrobiodiverse agriculture has become extremely challenging for campesino communities. Many small-scale farmers are not landowners; they have been displaced or have lost their land—and the local crops found therein—due to the armed conflict. Besides, as their agricultural systems become homogenized, smallholder farmers<sup>3</sup> are pushed to compete with large holders and agro-industries in globalized markets. For this, they are forced to privilege high-yield crops and to produce large volumes. Additionally, national agrarian policies have

prioritized agro-industrial production, leaving small-scale farmers few possibilities to preserve and use their own seeds following their traditional practices and livelihoods (Corrales Roa and Forero Álvarez, 1992).

In Colombia, the dynamics of land dispossession, forced displacement, and agrobiodiversity loss are particularly intense in the Caribbean region, where historical agrarian conflicts have violently reconfigured space (Ojeda, 2016). Large-scale agro-industrial monocultures of oil palm (Ávila González, 2015) and rice (Camacho, 2017), and pastures for extensive cattle ranching, have displaced local food systems and hindered campesino livelihoods. Conflict dynamics and the agro-industrial expansion have threatened the biocultural memory of smallholder farmers,<sup>4</sup> including their intergenerational knowledge, and their multiple practices through which people interact and which contain unique intergenerational knowledge about plant diversity and tropical ecosystems (Faguet et al., 2020; Cely-Santos and Hernández-Manrique, 2021; Van Dexter and Ingalls, 2021).

Although some studies have shown a relationship between land tenure dynamics and the Colombian armed conflict (Villarreal Escallón, 2021; Fortou et al., 2023), there are few insights on their effects on local food systems, crop diversity, and campesino livelihoods in the Caribbean region. In this research, we address this gap by assessing people's experience of the spatiotemporal impacts that regional agrarian conflicts have had on agricultural practices and crop diversity in a campesino community of the Colombian Caribbean. We focus on people's collective memory about land-use changes, documented through a participatory mapping, and a review of historical records regarding land tenure dynamics in the region influenced by agrarian conflicts.

## Methodological aspects

### *Study area: A campesino community in the Colombian Caribbean*

In the Colombian Caribbean, the colonization of forest areas to establish agricultural exploitations has been related to land grabbing by local elites,<sup>5</sup> since the Spanish colonization until today (Gómez et al., 2015). Land concentration has been a source for territorial control through which landowners have accumulated economic and political power to guarantee their privileges (Pachón

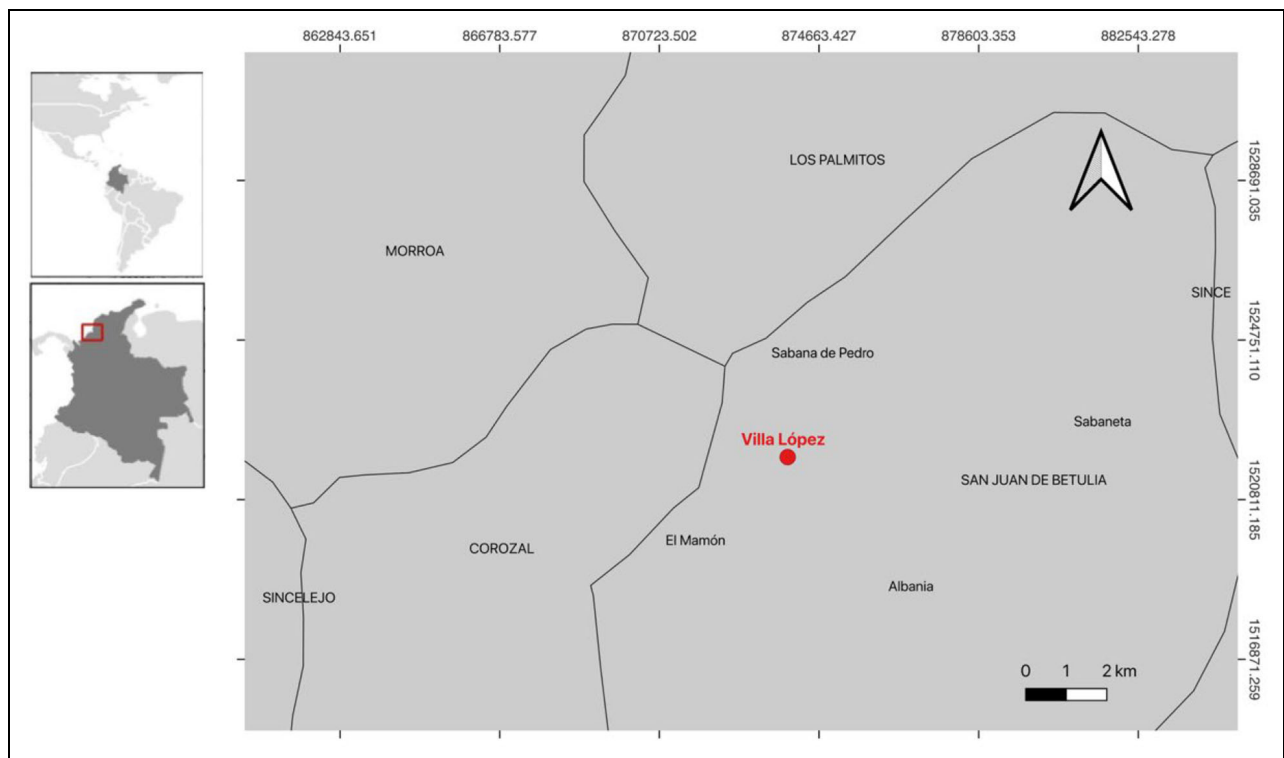
1. The armed conflict in Colombia has persisted for more than 60 years, and since its origins, it has involved demands for equitable access to land in a country with the highest rates of land ownership concentration in Latin America (Gini of 0.87, Pachón Ariza, 2022). In general, although recognizing that this conflict involves complex dynamics beyond the scope of this work, the conflict involves, among others, Marxist-origin guerrillas advocating for land redistribution, paramilitaries armed by large landowners, the Colombian state's violence, and the influence of drug trafficking. In this context, small-scale farmers have been victims of agrarian policies that favor powerful landowners, in a historical context of a lack of social justice, massive forced displacement, land dispossession, food insecurity, and violence over the past half-century (Berry, 2017).

2. In Colombia, *campesino* refers to smallholder farmers throughout the country. It is a term that stresses a common cultural, political, and economic identity in light of the historical struggles for land access and economic justice (Vega et al., 2019).

3. In this study, we consider a farmer to be a smallholder when managing a relatively small plot of land, usually less than 1.5 ha in the context of the Colombian Caribbean.

4. The question of how violent conflicts might impact agrobiodiversity was addressed in a special issue coordinated by Tamariz and Baumann (2022), which included interdisciplinary reports from other regions of the world. Several articles in this issue highlight an interdependence between violent conflicts and agrobiodiversity, stressing the need for further research useful for the recovery of community memory, the sustainable resolution of socio-environmental conflicts, and the conservation of agrobiodiversity.

5. In the context of the Colombian Caribbean, "*élites*" refers to select groups of individuals who possess a high level of power, influence, and economic resources within the regional society. These elites may include large landowners, prominent agricultural entrepreneurs, influential politicians, and other economic and social leaders who exert significant control over agricultural production, land distribution, and other activities related to the agricultural sector in the rural sphere (Comisión de la Verdad, 2022).



**Figure 1. Location of Villa López.**

Ariza, 2022). According to Machado (2009), the State has facilitated land concentration, mainly by avoiding or failing to implement a long-term land redistribution policy. Different governments have promoted the allocation of public land without redistributing large private properties in the most productive areas. Moreover, especially in the first half of the 20th century, public lands were appropriated by elites with impunity, using deforestation and forest burning, or buying in unregulated land markets to expand their properties. Often, accumulation was done through legal practices, for example, by arguing that the establishment of pastures or permanent crops represented “mejoramientos,” or land improvements, which justified obtaining land titles benefiting powerful economic elites (Ramírez, 2012).

In the face of such processes of land and power concentration, campesino communities in the Caribbean reacted with social mobilization to demand the recognition of their land rights (Comisión Nacional de Reparación y Reconciliación [CNRR], 2010). For example, in the 1970s, small-scale farmers in our study area (see below) occupied large private lands to push for redistributive land reforms. Such movements especially targeted large properties with unproductive uses, mainly extensive cattle ranching that allowed large owners to occupy vast areas without a real economic exploitation<sup>6</sup> (Fajardo, 1986; Centro Nacional de Memoria Histórica [CNMH], 2018).

6. In the Colombian agrarian law, land has a social function that refers to the owner's obligation to productively exploit the land. If such obligation is not fulfilled during a period of 10 years, the land can be claimed by others through different legal mechanisms (Vega et al., 2019).

*Villa López*<sup>7</sup> is a small village located in the municipality of San Juan de Betulia, in the department of Sucre, Colombia (Figure 1), mainly inhabited by smallholders who have grown cassava at some point in their lives. Villa López is strategically located between the Caribbean Sea, the savannas of the Córdoba department, and the mountainous Montes de María region. It is characterized by a warm and humid climate throughout the year, and a fragmented landscape with a few patches of dry forest in the middle of areas dominated by pastures for cattle ranching and cassava crops, common in the Colombian Caribbean region (García et al., 2014). This strong landscape fragmentation has significantly reduced biodiversity and placed the tropical dry forest at high risk (Quesada et al., 2009; Olascuaga-Vargas et al., 2016).

#### **Fieldwork description**

We developed 2 fieldwork seasons: from January to October 2021 and May to September 2023. At the beginning of each season, we did a local census, house by house, to determine the population and the total number

7. In 2016, we chose the village of Villa López as our study area after touring cassava-growing communities in the departments of Córdoba, Sucre and Bolívar, in the Colombian Caribbean. One of the authors (DP) was conducting research to assess the prevalence of a disease that occurs in cassava crops. That study required a village that, due to its size, allowed us to interview all the farmers who had grown cassava crops in recent decades. The results of that study demonstrated that land tenure is a key factor explaining the presence of Cassava Bacterial Blight (Pérez et al., 2022a) and provided the basis for undertaking this in-depth study on land tenure in Villa López.



**Figure 2. Individual mapping with farmers over 60 years old in Villa López.** (a) Field interview. (b) Selection of areas on the satellite image. (c) Result of a mapping done by a farmer. Photo by author.

of farmers. In 2021, 131 families inhabited Villa López, and 138 families in 2023.

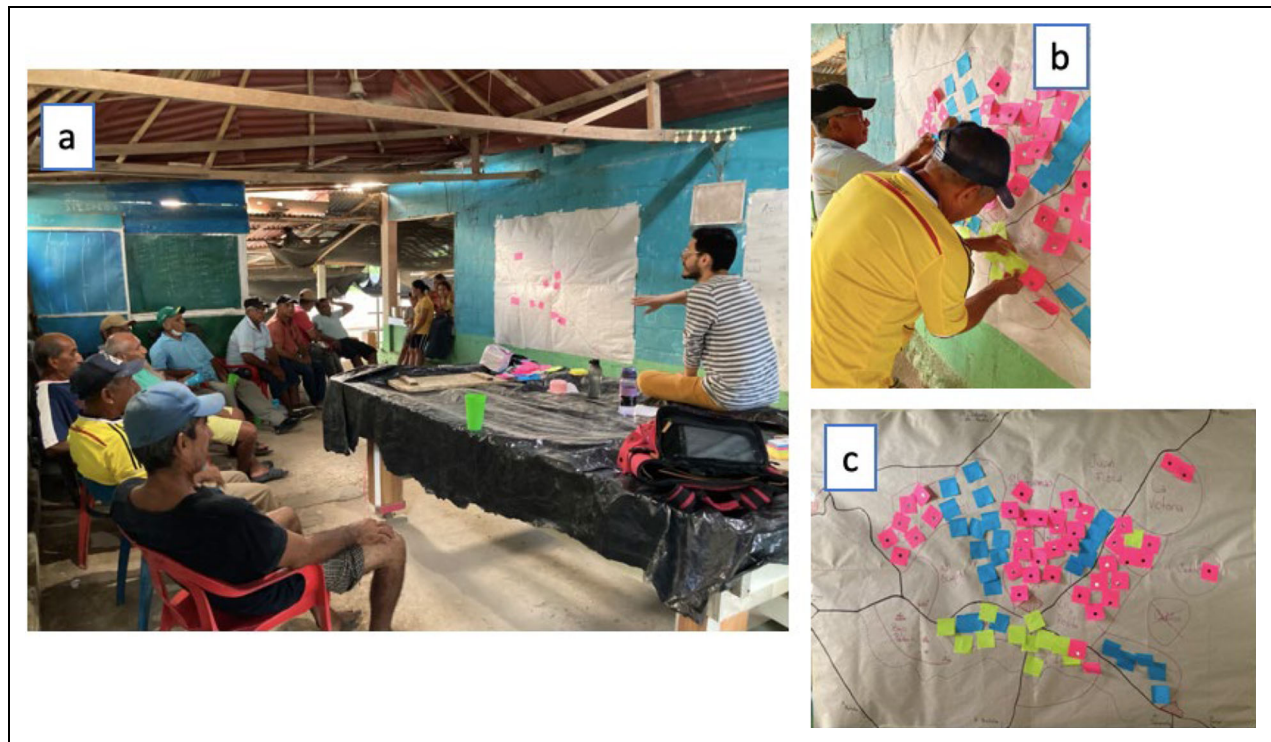
In 2021, we led an individual mapping exercise with farmers over 60 years old, who cultivated cassava on a small scale ( $n = 10$ ). The age criterion ensured that people knew about the land dynamics at least since the year 1975. Each interviewee, independently, was given a satellite image of Villa López and its surroundings (obtained from Google Earth) with transparent sheets to draw on top of it. Each transparent sheet represented a decade since 1975 (Figure 2). Farmers marked the sheets with the distribution of the main crops in Villa López, and the cassava varieties present in each decade. We used a color code for cotton (blue), tobacco (green), and cassava (pink). During each individual mapping, we asked open-ended questions about their memory of land use and distribution in the region.

Subsequently, we conducted a focus group with the same 10 farmers to verify the information and collectively discuss the results. We integrated the data from the individual interviews into this collective exercise. We grouped the areas that were named more than 3 times by the interviewed farmers and presented them on a bigger map, on which the participants located the crops and their varieties for each decade. We used the same color codes of the individual exercises to assign land uses to the maps with sticky notes (Figure 3). During the session, there were also open questions and discussions about land tenure in the region.

During the 2023 fieldwork season, we increased the sample and deepened the discussions on the territorial

dynamics, including other crops than cassava: yam, maize, tobacco, and cotton. In 2021, we did not interview women because we were focused on people who grow cassava, and this is an activity that is done by men. Therefore, in 2023, we applied a “snowball” sampling (Albuquerque et al., 2014) to interview those farmers, including women, with more knowledge about the agrarian history of the locality. We conducted 25 semi-structured interviews with farmers over 60 years old (17 men, 8 women), including the 10 participants of the fieldwork season in 2021. These interviews consisted of 40 questions about sociodemographic aspects, memory and local knowledge of the main crops of the region, and agrobiodiversity (Supplementary Material 1).

Villa López' residents identify themselves as *campesinos*, meaning smallholder farmers with strong attachment to their land and with customs inherited from their parents and grandparents. Most of the farmers we interviewed were born in Villa López (76%) and all have lived there at least since 1975. They have witnessed the change in land use and distribution in the locality, according to the periods evaluated in this study and identified with the research participants: 1975–1985, 1986–1995, 1996–2005, 2006–2015, and 2016–2023. Although there are no official records of the creation of Villa López, local people indicated that their grandparents already lived there, approximately a century ago. The results show that 72% (18/25) of the interviewed farmers were landowners prior to 1975, and these lands, inherited from their parents, were probably part of the land occupation struggles in the 1970s. The majority of farmers maintained areas of less than 1 ha (mainly planted with sweet cassava).



**Figure 3. Map construction in the focus group.** (a) Development of the focus group session. (b) Participants in the collective construction of the map. (c) Example of the final result of a map of a decade, in this case 1986–1995. Photo by author.

Usually, local owners of large areas (more than 5 ha) use the land for livestock and have some large-scale crops, especially bitter cassava.

Finally, we conducted an individual social mapping exercise in which each of the interviewees was asked to locate on a map of the village their economic activities since 1975 and the change in the varieties of food plants grown by them (Figure 4). Moreover, we asked open-ended questions about the conflicts associated with land use and distribution that they identified during the years evaluated, in and around their plots.

Before starting fieldwork in both seasons, we discussed the methodology and objectives of the research with community leaders. Interviews were conducted under informed consent and were recorded only if additional consent was given. The farmers own and hold the rights to the local knowledge presented here and their opinions remain anonymous, according to the agreements established with the community. In the next sections, we present and discuss the joint results of the 2021 and 2023 fieldworks, including the description of the memories of the agrarian and territorial conflicts in the area, and their effects on local agrobiodiversity and people's spatiotemporal relation with it.

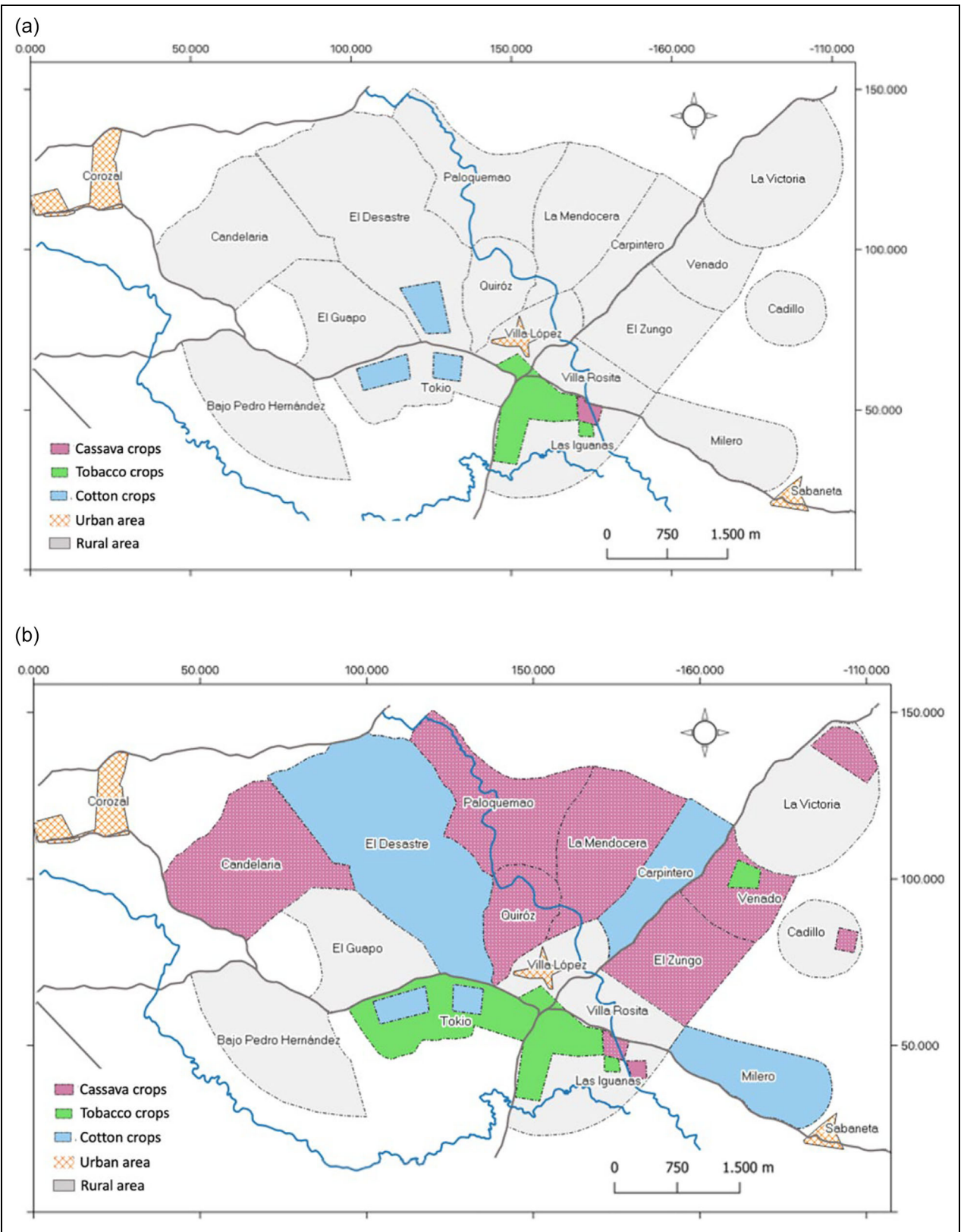
### Memories about agrarian and territorial conflicts in Villa López 1975–1985

Between 1975 and 1985, Villa López farmers mentioned that around their village, there were subsistence crops and livestock (Figure 5a). According to the interviews,



**Figure 4. Development of individual social mapping in 2023.** Photo by author.

although most of the inhabitants were not landowners and most of the land around Villa López belonged to large



**Figure 5.** Distribution of the main large-scale, commercial crops in Villa López. (a) 1975–1985 and (b) 1986–1995.

landowners, some farmers owned fields ranging from 1 to 3 ha, generally inherited from their parents and used for food crops necessary for basic sustenance such as cassava, yams, maize, and beans.

*[I have planted cassava] since my mother's time, in that time I was working in the fields, because that's what you eat. And with my mother all the time, because my father was killed early. They [the armed*

*groups] killed him in front of us. Well, my mother stayed, and my mother planted a little plot of half a hectare. She rented half a hectare and with that, we had a little plot to eat, because it was not to sell. All the time to have a little bit of cassava for breakfast. If you are going to make half a hectare and sell it, then what are you going to have to eat?* (Interview, February 2021)

According to the interviews, at this time large-scale crops were predominant, especially cotton and tobacco, and were already generating profits for large landowners in the region. Smallholder farmers were mainly employed in these plantations as *jornaleros*, that is, people who receive a standard wage per day in farming activities, for different tasks such as fixing fences, planting, applying agrochemicals, and moving livestock. The cultivation of cassava began as a strategy to feed the *jornaleros* who worked for the owners of these large plantations. This strategy was represented on the participatory map (**Figure 5a**), where farmers highlighted an area of cassava production (pink area) adjacent to the large-scale crops. During this period, international markets for Caribbean products such as bananas, tobacco, cotton, and cattle were opened, while staples and other products such as rice, cassava, and maize were grown in gardens to supply family needs (Posada-Carbó, 1998).

Farmers did not grow cassava for commercial purposes in the region; they rather lived from the wages obtained from their daily work. Thanks to *jornaleros'* activities, the population in Villa López increased. Several families migrated to the region because of the possibilities of working in the agribusiness of large holders, who hired 20–30 farmers daily to work as *jornaleros* or “*macheteros*,” that is, farmers who weeded, cut down, or burned the forest with machetes to clear the land for cattle ranching or industrial agriculture.

*Maybe there was more to earn [from jornalero's work] because before there was [the need for forest] clearing on the farms. They [largeholders] used jornaleros on the farms to clear the land where [nowadays] the pastures are [located]. We worked as contractors and jornaleros. Since December, the rich used to look for people here to open the fences, but not anymore. Nobody looks for people to clear anymore. In El desastre [name of a plantation in the area] they killed a cow every day to feed these people, and the rich, the boss, lived there on the farm* (Interview, February 2021)

While farmers obtained titles to some lands by the end of the 1970's after the land-occupation movements, most people retained ownership of these lands for only a few years. Those who had recovered or inherited their land from their parents eventually sold it since their work in other farms did not allow them enough time to work on their own properties. Selling land was also a strategy for responding to conflicts in the region. Farmers mentioned

losing their land since the early 1980s, which coincided with the paramilitary violence that forced many rural inhabitants to abandon their land (Grajales, 2011; CNMH, 2015).

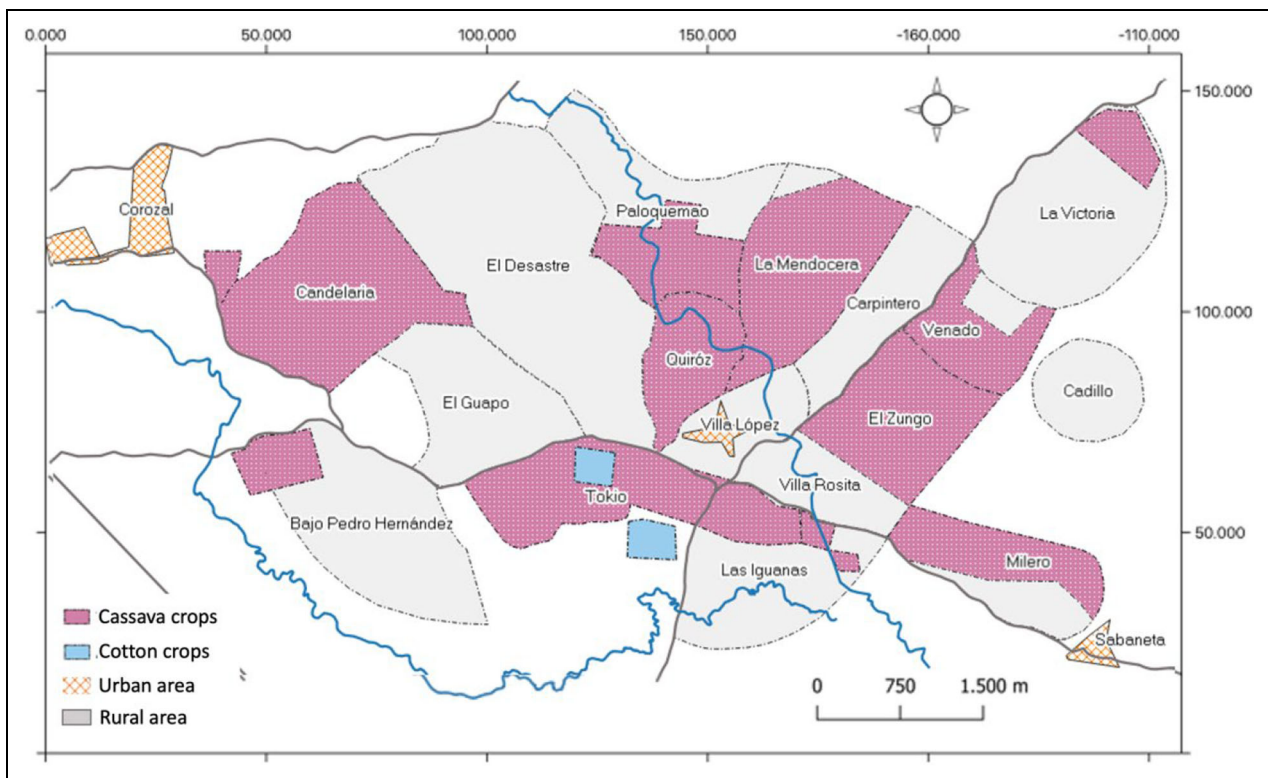
In the 1980's, the armed conflict expanded in the region along with agribusiness' interests and capitalist expansion. For instance, paramilitarism usually favored agribusiness by promoting a violent environment that forced farmers to abandon their land or sell it cheap, making it available for the accumulation by large landholders (Martín Peré, 2020). In fact, some farmers (36% (9/25)) reported that the armed conflict in the region forced them to move to larger cities in search of security. Forced displacement led to increasing urban population together with unemployment, as the rural population declined, especially in the department of Sucre (Aguilera-Díaz, 2005). Until 1985, the Colombian government provided large holders with economic resources to support the expansion of export-oriented agriculture, which boosted the growth of industrial businesses and increased employment opportunities for farmers (Zamosc, 1986).

#### 1986–1995

Land uses changed in Villa López between 1986 and 1995, according to farmers and their mapping of cotton, tobacco, and cassava crops (**Figure 6**). There was a notorious increase in the cultivation of cassava and its predominance in areas previously occupied by cattle, together with an expansion of cotton and tobacco crops.<sup>8</sup> This increase in cultivated areas may have been related to the incentives provided by the Colombian government during this period for the establishment of technological packages that benefited large-scale production of transitory crops, mainly rice, maize, cotton, and cassava (Balcázar et al., 1998; Bonet, 1999).

Given the vast areas of cotton and tobacco crops around Villa López, large-holder farmers had to find more efficient methods of agrochemical application, including

8. By the end of the 1970s, the cotton farming business failed in the Colombian Caribbean, especially in the department of Cesar (Gutiérrez-Lemus, 2012). Bonet (2002) states that, after 1978, there was a significant decrease in cultivation hectares in the interior of the country and in Cesar, probably due to the reduction of exports; but since the beginning of the 1980s, there was a slight recovery and most of the production was generated by municipalities near San Juan de Betulia, that are located in the department of Córdoba. This could explain the increase in cotton crops described by the farmers of Villa López during the 1980s. However, the entry of China and Pakistan into the world cotton export market caused a decrease in national production (Kalmanovitz and López, 2006). In the case of tobacco, which farmers place in the same proportion as cotton, the process was the opposite, since its business was relatively stable since the 1920s, and from 1985 it was probably decreasing (Tovar, 2013). Additionally, according to Arango Restrepo et al. (1988), in 1979, the spike in milk prices in the Colombian Caribbean region promoted further cattle raising. Both industrial tobacco crops and extensive cattle ranching provoked the dispossession of land from farmers and the fragmentation of natural ecosystems in the municipalities of Sucre (Fals-Borda, 1973; Kalmanovitz, 1998).



**Figure 6. Distribution of the main large-scale, commercial crops in Villa López between 1996 and 2005.**

air fumigation. Plantations were so big that an airport for aircrafts spraying agrochemical at large scales was built on a farm in the municipality of San Juan de Betulia. This activity strongly damaged the environment, the air quality, and the health of farmer families.

*The people civilized [i.e. to prepare the land for cultivation] with the cotton fields, because if they wanted to plant cotton, they had to leave it clean [the soil], without weeds, and the trees had to be cut down almost completely, so that the airplane could [fumigate], and that was what destroyed the fauna. When they threw that, and fumigated around here, the dead animals were thrown to the shore, the dead birds . . . (Interview, March 2021)*

Farmers mentioned that manual fumigation was done with little protection measures, which triggered health problems to many *jornaleros* and their families, especially respiratory illnesses and muscle pains. Many reported being hospitalized due to the side effects of agrochemicals. According to Wagner-Medina (2020), the use of agrochemicals in cotton crops in the department of Cesar (in the Colombian Caribbean) has produced environmental and human consequences that persist to this day, exacerbated by the scarce access to protective equipment. In fact, many agrochemicals that are banned worldwide are still used illegally in Colombia (Varona et al., 2010) or with very little regulation despite their harmful effects (Valbuena et al., 2021), weakening the health of the communities that apply them (Vargas Melo and Vallejo R, 1990; López et al., 2001). Although farmers

acknowledge the harmful effects, they still apply agrochemicals in their fields because of a perceived lack of alternatives within the agro-industrial system, benefiting large companies producing these substances (Camacho, 2017).

Despite the expansion of monocrop plantations, farmers reported the presence during this decade of 10 different varieties of sweet and bitter cassava (Table 1). The variety called *venezolana* predominated, with a shorter production cycle compared to the others. A variety called *monablanca* was also planted for family consumption due to its taste, although its longer crop cycle made it less marketable. Farmers say that the *venezolana* variety produced yields after 5 months, which enabled planting cotton and cassava in the same year. Thus, cassava was planted during the first months of the year, with the first rainy season, and harvested from September onward, during the second rainy season, after which cotton was planted.

*There were a lot of varieties, but the seed is getting lost. You know that what is important in the variety of a seed is its production. For example, the venezolana variety of six months is already producing cassava in 4-5 months, and now it is the chiroso that thickens faster. But the best cassava to eat of all the cassava varieties is the monablanca. The monablanca used to be planted practically to leave it to eat, it was not very commercial. Farmers left the little piece [of stem] planted and it did not deteriorate. That cassava was slow, it was harvested*

**Table 1. Cassava varieties recorded in Villa López**

Variety	1975–1985	1986–1995	1996–2005	2006–2015	2016–2021
Batea	x				
Monablanca	x				
Botón	x				
Pata de paloma	x				
Mingana	x				
Segundera	x				
Amarilla	x				
Caribeña	x				
Guarumera	x				
Venezolana	x	x	x	x	x
Playera			x		
Cedrón		x	x		
Negrita				x	
Polvo de la prima			x		
ICA Costeña					
MTAI			x	x	
Despelucada				x	
Cogollo verde				x	
Chirosa					x

*after 8 months. It took a long time to thicken, but it was tasty to eat. It was tasty to eat, but they don't plant it anymore. You don't see a monablanca plant here anymore (Interview, March 2021)*

### 1996–2005

In the following decade, from 1996 to 2005 (**Figure 6**), farmers said that tobacco cultivation disappeared from the region and cassava crops increased significantly. These cultivations were made using the methods learned from their parents and grandparents, complemented with the techniques and inputs of industrial agriculture promoted by state institutions.

Cassava cultivation was consolidated and increased in some fields, due to the expansion of the market for both cassava flour and fresh cassava (as reported by Gottret and Raymond, 2003). Previously forested lands were cleared due to mechanization and the excessive use of agrochemicals (García et al., 2014), which facilitated the conditions for cassava cultivation. Farmers continued to work as *jornaleros*, but this time they help the expansion of their employers' cassava cultivation. In addition, when cassava was harvested, instead of planting cotton, farmers replaced it with sesame, which did not have a regional market but served to supply local consumption needs.

When we asked about crop composition and land distribution during this period, stories about the armed

conflict emerged as a common factor. The area of industrial crops in San Juan de Betulia increased considerably, which could have been related to the consolidation of a phenomenon of massive and rapid land accumulation, as reported for other municipalities in the Colombian Caribbean. In this process, local elites accumulated properties thanks to the support of the state and illegal armed groups (Vargas Reina, 2022) amid new opportunities in global markets and the governmental neglect of agrarian reform. Thus, changes in land ownership ensured the expansion of agribusinesses dominated by a few, while farmers lost possession of their land and became economically dependent on large holders. This was the case of oil palm in the Caribbean region, as the business expanded due to displacement and dispossession dynamics that were caused by armed groups (legal and illegal) and benefited large landowners (Grajales, 2013; Maher, 2014).

The armed conflict was a determining factor in the agrarian dynamics and influenced the way of life of Villa López's farmers. In farmers' narratives, violence appears as a common factor, closely related to land distribution. Farmers mentioned the presence of paramilitary and guerrilla groups in the region, and these years are remembered for a constant sense of fear and anxiety. In several interviews, the memory of violence is present, especially because some relatives or friends of Villa López farmers were killed in actions committed by paramilitaries in nearby municipalities such as Morroa, Carmen de Bolívar, or Ovejas. Many families moved to large cities such as

Corozal or Sincelejo or migrated to Venezuela in search of better opportunities and physical safety.

*We left when the violence came. Here they killed her [his wife's] father, here at the door. There was a tree of mamoncillo and they were shooting at it, and even the shell of the tree of mamoncillo [Melicoccus bijugatus] fell off. The guerrillas killed him with a rifle. Well, then, we went to Venezuela, there in Venezuela we started to work. There, in Venezuela, we built a little house with the effort of our lives, and then we lost the little house [because the Venezuelan government deported all undocumented Colombians], now we have neither there nor here (Interview, February 2021)*

Although there are no direct reports of armed incursions in this locality, the combination of territorial conflicts, the presence of armed groups, and generalized violence in the region created an ambience of fear and oppression in people's daily life. For example, in the Montes de María region (less than 50 km from our study area), between 1996 and 2001, paramilitaries carried out more than 70 massacres against farmers whom they arbitrarily accused of supporting the FARC guerrilla (FUCUDE et al., 2020). These violent actions caused massive displacements of farmers from rural areas to nearby larger cities, especially Sincelejo, capital of the department of Sucre (approximately 20 km from our study area) (CNRR, 2010; CNMH, 2015).

### 2006–2015

Starting in 2005, several paramilitary groups joined the demobilization process agreed after negotiations with the national government, which diminished the armed conflict in the Colombian Caribbean. However, the territorial dispossession had already changed the dynamics of land tenure, leaving a deep fracture in society (Thomson, 2011; CNMH, 2018). For the case of Villa López, land tenure conflicts are one of the main consequences left by the war. Specifically, since the farmers were dispossessed of their plots (60%,  $n = 15$ ), they depended on contracts provided by large holders. However, according to farmers' testimonies, during this decade few agro-industrial plots were planted, and a shift to cattle ranching took place. This coincides with the literature that indicates that Colombian governments after the 1990s promoted policies of economic liberalization that mainly benefited large-scale monoculture and livestock farming and favored the imports of foods that used to be cultivated by small-scale farmers in the country (Fajardo, 2019).

Due to land concentration promoted by the new owners, small-scale systems were replaced by larger exploitations prioritizing the cultivation of few varieties with agronomic characteristics favoring their mass commercialization. This period of rapid land concentration coincides with a decrease in the number of cassava varieties reported by farmers, as they prioritized the use of more commercial varieties. The planting of bitter cassava

varieties began in Villa López with the arrival of enterprises with technologies to dry the roots, allowing the commercialization of cassava starch to regional associations and private companies. The *monablanca* variety was no longer mentioned in this decade, while the *venezolana* variety became dominant. Some farmers mention that the production range of this variety increased from 5 to 7 months, due to the reduction in soil quality.

According to the collective mapping, during the decade of 2006–2015 (**Figure 7**), approximately half of the cassava crops were replaced. Few fields with cotton were still managed by farmers from Villa López. Large holders, who previously considered agriculture as a profitable economic activity, transformed their land to cattle ranching.

According to the interviews, the sweet cassava market decreased in this decade and became less attractive for large landowners, who reduced its cultivation. Moreover, the production of bitter cassava has increased considerably in the Caribbean since this decade (FAO, 2022), which can be explained by a higher demand for starches for the industry (Aguilera-Díaz, 2012). This left the possibility for Villa López farmers to plant and commercialize it at a small scale (<1 ha) because there was less competition with previous producers who were able to place large volumes of sweet cassava on the market. All the areas represented in the map (**Figure 8**) were specialized in the cultivation of the more commercial bitter cassava, while small-scale farmers specialized on sweet cassava. However, these sweet cassava crops were grown in rented areas, often located within or near the estates of large holders, who profited from this rent and could use the rest of the area for other economic activities. Thus, although it is not reflected on the map, based on the farmers testimonies, small areas with different crops were found to be scattered amidst the larger cassava plantations in the areas near the urban center, alternating food crops such as yams and maize. In general, a further decrease in the number of cassava varieties was reported; most planted cassava were monocultures of the *venezolana* (sweet cassava) and *MTAI* (bitter cassava) varieties.

Therefore, the work of *jornaleros* decreased significantly due to the decrease in large-scale cultivation of bitter cassava. In consequence, small-scale farmers took the opportunity to become more economically solvent by producing it themselves but also more exposed to market dynamics. Some farmers mentioned that prices depended on external factors such as planting times, weather conditions, product prices, and demand. On the other hand, although less regularly, there were additional paid-work opportunities on the larger farms. Farmers mentioned the nostalgia of working in tobacco farms, as this provided a weekly or monthly income, while the profits from cassava cultivation only came once a year, after selling the entire harvest.

### 2016–2023

In recent years, from 2016 to 2023, farmers said that the cassava business deteriorated and, in response, the cultivation of large-scale bitter cassava and small-scale sweet cassava have significantly reduced (**Figure 8**). Likewise,

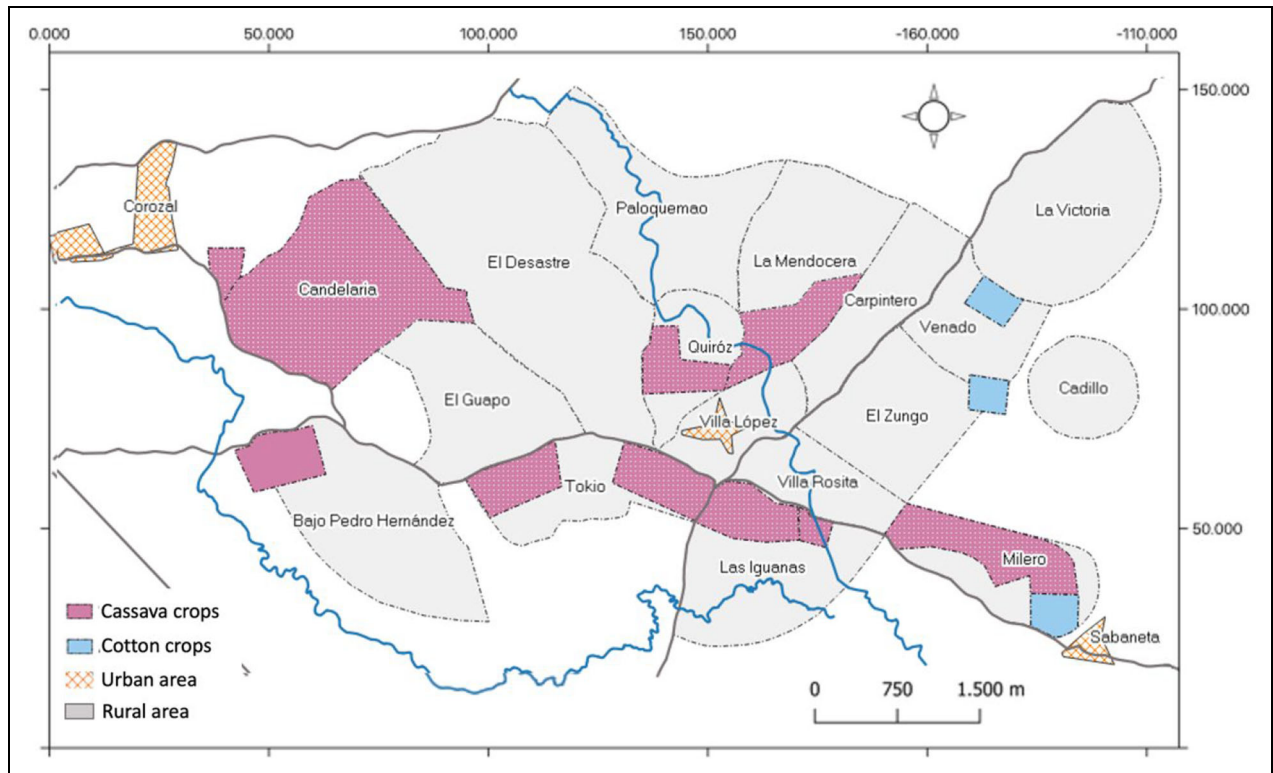


Figure 7. Distribution of the main large-scale, commercial crops in Villa López between 2006 and 2015.

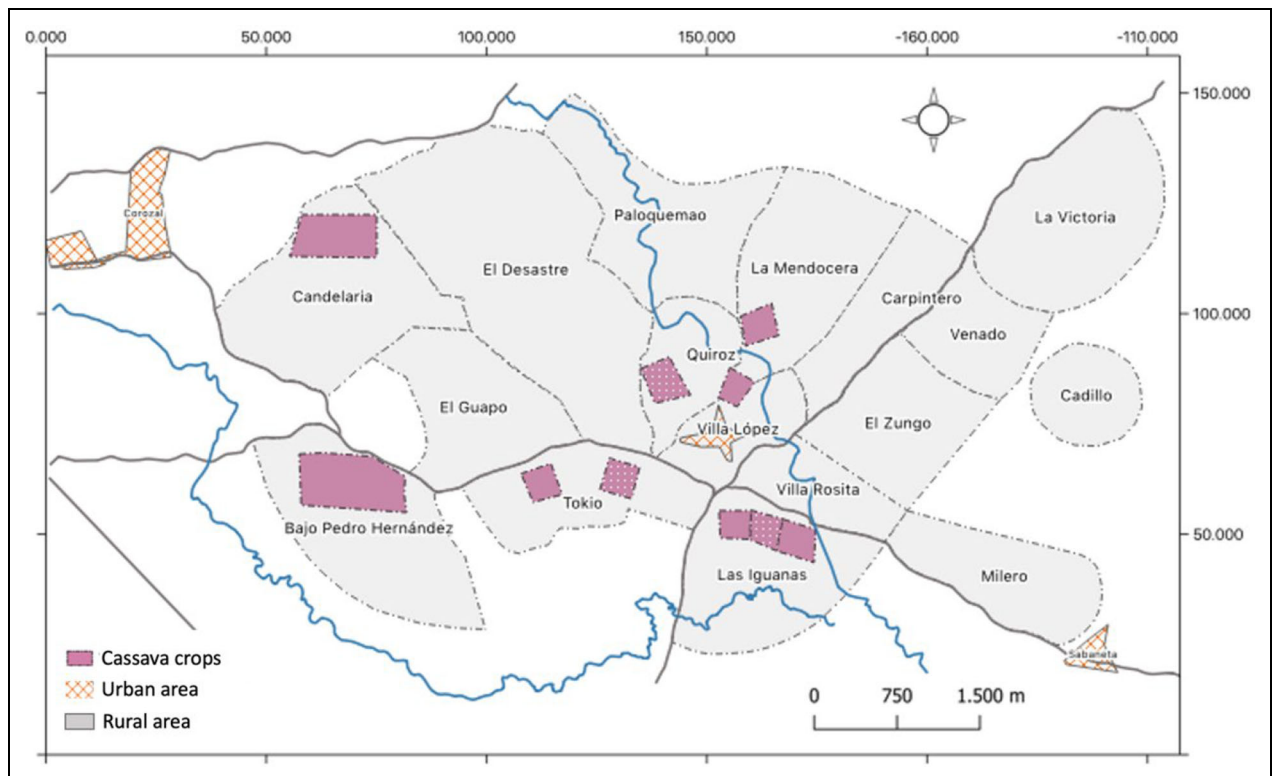


Figure 8. Distribution of the main large-scale, commercial crops in Villa López between 2016 and 2023.

farmers affirmed that cattle ranching became predominant. Farmers of Villa López have stopped planting cassava on a small scale because the low market prices, dominated by middlemen, do not compensate the costs

of renting land, buying inputs and paying seasonal labor. According to some, the *chirsa* cassava variety has been gradually replacing the *venezolana* because it can be planted at a higher density, which ensures higher yields.

Today, all crop fields are planted with this variety, sometimes mixed with *venezolana*.

The number of people planting sweet cassava has kept dropping in most recent years; farmers of Villa López have seen an income opportunity with bitter cassava due to the emergence of regional associations that serve as closer intermediaries. Associations buy harvested cassava to transform it into starch and sell it to the food industry. Currently, 15 farmers alternate cassava cultivation with cattle ranching to guarantee a daily income.

Additionally, farmers in Villa López have stopped growing their own staple foods because they have lost their land and the market is increasingly unequal. Besides the big inequalities in supply chains, farmers have to face the consequences of the climatic crisis and persistent violence in their territory. This is not an isolated fact. In other regions of Colombia such as southern Urabá or northern Chocó, the change in land use due to dispossession and forced displacement to favor the expansion of cattle ranching and oil palm caused the reduction of small-scale food production for subsistence (CNMH, 2018).

### Current main crops and the loss of crop diversity

According to Villa López farmers, they have been progressively reducing the cultivation and use of vegetal species and varieties grown in the region. Because the farmers interviewed do not own their land, they prefer to use most of their plots for crops that can be sold, instead of planting for self-subsistence. Some food species important for the local diet used to be grown within the commercial plots, but now only a few farmers keep seeds or grow those plants. This is the case of *batata* (*Ipomoea batatas*), *millo* (*Panicum miliaceum*), *níspero* (*Manilkara zapota*), *guandul* (*Cajanus cajan*), *culantro* (*Eryngium foetidum*), *pepino criollo* (*Sicana odorifera*), and *ají* (*Capsicum annum*). Likewise, some non-timber forest products can still be found, but their use as food has decreased depending on their availability in the dry forest patches in the region (Rodríguez et al., 2012). Some plants of wild origin that remain within the plots are still part of the local diet, although less frequently, such as *corozo* (*Bactris guineensis*), *guama* (*Inga* sp.), *algarrobo* (*Hymenaea courbaril*), *caimito* (*Chrysophyllum cainito*), *guásimo* (*Guazuma ulmifolia*), and *bleo* (*Amaranthus dubius*).

The diversity of both cultivated and wild plants has decreased as a direct effect of market dynamics. Almost all farmers stopped saving their seeds and replaced them with commercial varieties, making the use of these plants in their traditional recipes marginal or dependent on market availability. This has been reported for other municipalities in the region (Pasquini et al., 2014; Cárdenas Botero et al., 2016; 2023). Most farmers' plots now contain mainly cash crops of cassava (*Manihot esculenta*), yam (*Dioscorea* spp.), and maize (*Zea mays*). Similarly, local varieties of these 3 plants, called "*criollas*," used by farmers for particular traditional preparations, have been replaced by improved varieties. These new seeds have been promoted by Colombian agrarian institutions, as a strategy to allegedly avoid phytosanitary problems or to reduce

harvesting times, responding to market requirements (Perelmuter, 2021). For instance, the farmers mentioned that they used to grow a maize *criollo* for self-sustenance, but the increasing commercialization of maize in recent decades favored the improved varieties, such as the *cinco*. No one plants *criollo* maize in Villa López anymore and for that reason it is difficult to determine to which variety they belonged or their diversity, especially considering that in Colombia there is a relatively high variability of maize seeds that are traditionally called *criollos* (Peñaranda and Navas, 2005; Revelo Portilla et al., 2015).

Nevertheless, most farmers still use specific moments prior to planting or harvesting the main commercial crop to grow some food plants to supply the needs of their families. This is the case of *ajonjolí* (sesame, *Sesamum indicum*), *fríjol* (beans, *Phaseolus* sp.), *patilla* (watermelon, *Citrullus lanatus*), *ahuyama* (squash, *Cucurbita maxima*), *melón* (melon, *Cucumis melo*), and *berenjena* (eggplant, *Solanum melongena*).

### Yam in Villa López

Changes in yam cultivation are relevant for farmers of Villa López, as this plant has been one of their main sources of livelihood and they consider it a fundamental crop in their diets. In fact, yam commercialization in the Caribbean region has increased especially thanks to its easy adaptation to biophysical and climatic conditions, as well as its ability to remain fresh for several weeks, which allows its storage for selling and consumption (Reina-Aranza, 2012). According to Raz (2016), it is estimated that 55 yam species grow in Colombia, of which only 5 (4 exotic and 1 native) are cultivated. Despite this diversity, yam cultivation has been reduced to only one commercially introduced species, *Dioscorea alata*. In the interviews, Villa López farmers identified 5 varieties of yam that were most commonly planted in the past: *criollo*, *baboso*, *morado*, *espino*, *diamante*. All the farmers affirmed planting the *diamante* variety, because of its shorter growing cycle and the structure of its tuber that makes it easier to harvest. However, 20% ( $n = 5$ ) of the farmers still keep some seeds of the *espino* yam, because they prefer its taste especially in a traditional recipe called "*mote de queso*" (yam soup with cheese).

Yam cultivation in Villa López is usually associated with cassava, starting in March or April during the rainy season, with a first harvest in October. Farmers mentioned that yam should be planted at a considerable distance from the other crops to facilitate harvesting and to prevent the growth of the tuber limiting the space for the development of the cassava root or other associated species.

### Cassava in Villa López

The main economic activity of the inhabitants of Villa López in recent years is cassava cultivation (Pérez et al., 2022a), hence the variety diversity was more salient for this species. During the interviews, farmers recalled several cassava varieties, which indicates that, in the past, the criterion for variety conservation was not exclusively commercial. There were preferences related to patterns such as diet or adaptation to changing climatic conditions, which

coincides with what has been reported in other regions such as the semiarid areas of Brazil (Santos et al., 2020).

During the interviews, farmers remembered common names of local varieties that were inherited from their parents and grandparents, especially the *monablanca*. According to Jaramillo (2001), this variety is part of the first breeding programs carried out by the International Center for Tropical Agriculture (CIAT) in the Colombian Caribbean and was reported in its collection since 1969. Thus, its introduction must be prior to that date (López et al., 1989). Farmers could have a special memory of this variety because of its taste and because it was the seed that they began to sow in their first plots. Although there are no specific written reports of it in Villa López or San Juan de Betulia, studies by Alzate et al. (2010) that included samples from San Juan de Betulia found that it was grown in the region at that time.

Other cassava varieties were present in farmers' memories. The *batea* and *pata de paloma*, which the farmers of Villa López recall being grown in early 1980s, were also reported for the region by Patiño (1964). That is, considering that these varieties are reported prior to the first institutional breeding programs, their origin may be related to artificial selection made by the farmers of the region, intentionally favoring agronomic characteristics such as taste and productivity, as has happened in other cassava farmers communities (Sambatti et al., 2001). Besides, farmers recalled the *venezolana* variety, which is still in use in the Colombian Caribbean (Alzate et al., 2010; Pérez et al., 2022a). Although its introduction was spontaneous through the migration of farmers working in the state of Zulia (Venezuela), it was evaluated and became part of the CIAT breeding program in 1979 (Gottret and Henry, 1994). However, in recent years, the *chirosa* variety has been selected by farmers in the region because its taste and production times are similar to those of the *venezolana* variety, but its roots extend along the vertical axis of the plant, which allows a higher planting density (Pérez et al., 2022b).

### **Discussion and conclusions: Crop diversity changes are inseparable from the agrarian conflict and market dynamics**

The case of Villa López in the Colombian Caribbean shows the extent to which changes in crop diversity, a key element of agrobiodiversity, are closely related to the historical dynamics of the agrarian conflict and globalized markets. In our study, people's descriptions of their relation to key plant varieties show complex interplays between the violent history of the Colombian agrarian conflict, processes of land concentration, the influence of globalized market dynamics, and the expansion of industrial agriculture. As a result, agrarian conflicts have reconfigured the landscape of Villa López and changed the economies and practices of campesino communities. However, based on their own experiences and memories, our results reconstruct part of the local agrarian history, demonstrating the persisting *campesino* identity and its inextricable link to their land.

People's narratives show how the expansion of industrial agriculture within agrarian policies promoted by national governments and globalized market dynamics affected crop diversity and smallholder livelihoods. Already in the late 70s and early 80s, commercial monocrops such as cotton and tobacco turned smallholder farmers more dependent on waged labor in large-scale exploitations. This process continued in the 90s, with economic liberalization, when cotton and tobacco were replaced by cassava varieties with high demand in globalized markets. In parallel, processes of agrarian conflict fueled campesino's land dispossession, turning them more dependent on waged work and market dynamics of large-scale monocrops, and reducing their dedication to their traditional and more diversified small-scale agriculture. In general, smallholder farmers had to adapt, by adopting high-yield varieties or renting their land at the expense of those local varieties that have been selected and bred by campesinos through many generations.

In our results, the case of cassava illustrates the interplays between market dynamics, agrarian, and land tenure conflicts. When farmers were able to keep ownership of their plots, they planted varieties with higher productivity alternated with those preferred for their taste and with a link to cultural identity, even if they had longer production cycles. However, when they were violently dispossessed of their land or forced to rent it to grow commercial crops, they prioritized more productive varieties to obtain harvests in less than a year, which is the standard time to keep a small-scale plot under lease. These dynamics can still be observed nowadays. The bitter cassava business has been growing in the Caribbean region: the *ICA costeña* and *MTAI* varieties were the ones that have remained over time because they have been part of the institutional breeding programs since the 1980s (CORPOICA, 2004) and the ones that buyers of cassava starch prefer for their yields and quality. Additionally, the increase in small- and large-scale cultivation of bitter cassava identified by farmers in the studied decades coincides with FAO (2022) reports that indicate an increasing of the production of bitter cassava in the Caribbean in the last decades, explained by the growth in demand for the national food industry (Aguilera-Díaz, 2012). This is not an isolated event. In recent years, the market for bitter cassava has increased worldwide due to its potential as food and raw material in various industries (Parmar et al., 2017). For example, research on the possibilities of using its derivatives in the gluten-free bread industry (Sigüenza-Andrés et al., 2021), due to the growing demand for this type of product in the market (Roman et al., 2019).

Despite the increase in the industrial cultivation of highly productive cassava varieties, our results show that some dynamics favoring crop diversity persist. According to the report of cassava cultivation in Villa López in 2016 (Pérez et al., 2022a), in the last few years, more farmers started growing small-scale bitter cassava (2 farmers in 2016 and 8 in 2021). While bitter cassava has been planted mainly by large landowners due to its high input costs, smallholder farmers have maintained plots on a small scale together with other plants prioritized for consumption instead of

commercialization. In this way, both commercial (i.e., cassava, yam, or maize) and self-sustaining (i.e., sesame, beans, squash, or eggplant) species have been planted considering the seasonality of cassava cultivation (Pérez et al., 2022a). This suggests that some crop diversity and associated traditional practices might persist. Once the land is prepared, cassava cuttings are planted together with fast-growing seeds, such as maize. Subsequently, when the cassava is harvested, maize is sown again together with sesame, which is a frequently used species in traditional preparations and has had a growing market during the last decades (Pérez-Bolaños and Salcedo-Mendoza, 2018). Therefore, while our results stress crop diversity loss, further research is required to understand the persistence of traditional practices amid the homogenizing tendencies cause by conflict and market dynamics.

Our research provides evidence on how agrarian conflict dynamics, including land concentration, favor the expansion of industrial agriculture at the expense of campesino livelihoods supported by practices based on crop diversification. This evidence relates to the literature on critical agrarian studies, which has shown how capitalist expansion and capital accumulation processes benefit from violent agrarian conflicts that create favorable conditions for the incorporation of agro-industrial models and the conquest of new frontiers for capital accumulation (Chohan, 2024). In particular, our methodological approach of reconstruction of local memory through participatory mapping provides firsthand insights into historical dynamics and people's lived experiences and everyday struggles. This follows other studies in the region stressing the value of ordinary, everyday practices that represent forms of negotiation, resignification and resistance to the dispossession and violence promoted by industrial agriculture (Ojeda, 2016; Berman-Arévalo and Ojeda, 2020).

Finally, our results are not only a documentation of the vulnerability of campesino livelihoods to the violent dynamics of capitalist expansion through industrial agriculture. Instead, our research shows elements of persistence of a campesino identity and its biocultural memory closely related to land and crop diversity. In the Caribbean region, several campesino movements have relied on agrobiodiversity as a key component of their struggles for land rights, economic autonomy, and political recognition (García López et al., 2019). While the campesino community of Villa López has not achieved such a level of political organization and collective action, and the impacts of the agrarian conflict have hindered its capacity to build a strong movement, our results suggest the need to further understand the persistence and emergence of agrobiodiversity and traditional practices, in order to better inform proposals for a comprehensive, fair and transformative agrarian reform that is historically owed to campesino communities in Colombia.

#### Data accessibility statement

The data associated with this research are not publicly available to protect the privacy and confidentiality of the human subjects who participated in this study. However, they can be available upon reasonable request to the authors.

#### Supplemental files

The supplemental file for this article can be found as follows:

Suppl\_mat\_1.docx.

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#### Competing interests

No potential conflict of interest was reported by the authors.

#### Ethics statement

The research was reviewed and approved by the ethics committee from Universidad de los Andes (Act 1190 of 2020). The participants provided their written informed consent to participate in this study.

#### Author contributions

Contributed to conception and design: DP, NAD-C, MC-S, SO-P.

Contributed to acquisition of data: DP, NAD-C.

Contributed to analysis and interpretation of data: DP, MC-S, SO-P.

Drafted and/or revised the article: DP, NAD-C, MC-S, SO-P.

Approved the submitted version for publication: DP, NAD-C, MC-S, SO-P.

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