



Profile of migrants for cocoa production and agronomic characteristics of cocoa farms in Western Côte d'Ivoire

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Abstract

The mountainous relief of the West of Côte d'Ivoire and the large savannahs next to forests didn't make this zone very excellent for cocoa production. However, for the last decade, an important influx of farming population has been observed in this area. The objective of this study is to analyze the dynamics of the settlement of migrant farmers in the West region of Côte d'Ivoire, using the department of Biankouma as a case of study. So, individual surveys were conducted among 203 cocoa farmers from 15 villages in the department of Biankouma, who had migrated to this region. It was found that the majority of these farmers are natives of Côte d'Ivoire (38.3%) and non-natives (33.5%) from countries in the West Africa region. The migratory flow to this region is mainly internal, with 95.6% of farmers coming from 11 Districts and 55 localities in the country. While initially (i.e., before 1985), farmers came from towns near Duékoué (11.8%), these waves of movement from towns in neighboring districts (Bas-Sassandra and Sassandra-Marahoué) to the Western Region will experience their highest rates between 2002 and 2013. Observations drawn from our research findings support the hypothesis that the political-military crisis that the country has experienced has accentuated migratory flows of farmers for cocoa production in western Côte d'Ivoire and these migratory flows could be the cause of the degradation of forest cover in the Biankouma Department.

Keywords: Migratory flows; Indigenous; Allochthonous; Allogenuous; Cocoa farmers; Western of Côte d'Ivoire

1. Introduction

The most profound transformations that affected the Earth's surface in the second half of the 20th century were, on the thirteenth part, the extension of urbanised areas and, on the second part, the search of new farmland to the detriment of tropical forests [1]. Côte d'Ivoire, as all West African countries, has undergone major changes in its forest landscape since independence [2]. As an agricultural country, Côte d'Ivoire has experienced population movements and strong land pressure in the countryside since the popularisation of export agriculture dominated by the pair of coffee and cocoa crops. So, since the 1920s, the demographic growth of forest regions and the degradation of vegetation cover have been inextricably linked to the development of cocoa farming [3].

The moving of cocoa production centres from the introduction area to the East of the country and then to the South-west follows a model described as 'forest rent', dependent on the tropical forest and migrations. Although these different waves of migration allowed the extension of cocoa areas and maintained of a sustained rate of cocoa production, they have helped to mask the difficulties linked to the replanting of old orchards in the oldest zones [4]. Moreover, national statistics do not sufficiently demonstrate these cycles since the production of new pioneer zones hides the decline of older zones. While it is clear that the extensive coffee and cocoa plantation economy is doomed to disappear due to the

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increasing scarcity of forests, the migrant networks are maintained and even extended to other regions and other production systems [5]. Indeed, associative organisations of foreign migrants constitute networks of land acquisition, often from the origin country until the integration of newcomers. In addition to these organisations, some migrants have themselves clandestinely developed parallel initiatives to bring foreign labour into cocoa plantations [6].

In a such context, and considering the early development of the cocoa economy in the western region of Côte d'Ivoire, one might wonder about the possible links between agricultural migration and the development of cocoa farming. Also, the influence of former cocoa production areas in the colonization of the forest landscape of this region is still poorly known. This study is based on two hypotheses, the first one stipulates that the military political-crisis that the country knew, has accentuated migratory flows in western of Côte d'Ivoire; and the second asserts that these migratory flows have strongly contributed to increase the extension of cocoa- areas and the development of this crop. Thus, the objective of the study is to understand the settlement dynamics of cocoa farmers in this region. The aim is to (1) determine the socio-demographic characteristics of cocoa farmers settled in the department of Biankouma, (2) analyse the dynamics migration of farmers and (3) draw up a profile of migrant farmers in this region.

2. Methodology

2.1. Geographical location

The present study took place in the west of Côte d'Ivoire, in the department of Biankouma located between 7°18'00"-8°12'00" North latitude and 7°0'00"-8°12'00" West longitude. It is bordered to the north by the department of Fougbeesso and to the south by the departments of Man and Facobly. The department of Biankouma is located in a transition zone between sub-equatorial and tropical climates [7]. It is influenced by a mountainous climate [8] with an average temperature of between 24°C and 28°C and an average rainfall of between 70 and 80 mm/year. The department of Biankouma is located in a transition zone between the ombrophilous and mesophilous sectors. There are savannah formations, forest formations and mixed savannah and forest formations that intermingle [9]. Coffee orchards occupy a large part of the cultivated areas of department, with production estimated at more than 105,000 tons during the 2015-2016 season [10]. However, people are more and more interested in cocoa farming [11].

2.2. Data collection on cocoa farmers

A first batch of 30 villages were selected based on previous work [7,12], and recent vegetation maps of the area. Subsequently, a working and information session with agents of the Agence Nationale d'Appui au Développement Rural (ANADER) in Biankouma, a farmer support structure, permit to define criteria on the basis of which 15 villages were selected for the field surveys. These criteria were based on the volume of production in the locality during the last seasons, on the representativeness of different local communities in cocoa production and on the availability of original vegetation cover (forest or savannah). A survey questionnaire was therefore developed to describe the profile of farmers, namely: period of installation, place of origin, origin, age and previous activity.

2.3. Data analysis

Three categories of migrants were considered in this study according to [13]: Indigenous, Allochthonous and Allogeneous. Indigenous migrants are Ivorian farmers from the department of Biankouma who, at some point in their lives, had to move to a location other than their borning locality in order to practice other occupations, but who, upon their return to the department, practice cocoa farming. Allochthonous migrants are Ivorians who are not from the department of Biankouma. Finally, allogeneous migrants are non-Ivorian cocoa farmers.

The collected data was processed using the Sphinx software (free software). The socio-demographic characteristics of the farmers and the agronomic characteristics of the plantations were analysed by calculating the rate according to their origins. In order to understand the dynamics of the installation of farmers, the coordinates of their origin localities obtained at the end of the surveys were generated from the Geolocate online software. All these informations were exported to the QGIS 2.14 software to produce maps of the spatial distribution of production areas and the installation period of the famers.

In order to understand better the relationships between the different variables used and to establish a profile of the migrants, a Multiple Correspondence Analysis (MCA), coupled with a hierarchical ascending classification (HAC) [14], proved necessary. Chi-square tests were performed on the coordinates of the MCA variables [15], to check the homogeneity of the groups. The FactoMineR package of the R software was used for this purpose.

3. Results

3.1. Socio-demographic characteristics of cocoa farmers

The survey carried out permitted to interview 278 cocoa farmers in the Department of Biankouma. A predominance of migrant farmers with a rate of 74.1% against 25.9% for non-migrants was observed (Figure 1). Considering the origin of migrants, Allochthonous farmers are the most important (38.3%). They are followed by Allogeneous farmers and Indigenous farmers with 33.5% and 28.2% respectively (Figure 2).

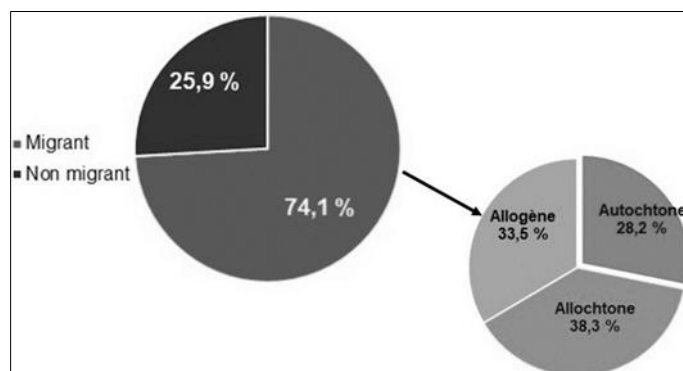


Figure 1 Origin of cocoa farmers in the department of Biankouma

The age of the migrant farmers surveyed varies from 18 to 78 years, with an average of 39 years. The average age by origin is 37 (Allochthonous), 35 (Allogeneous) and 47 (Indigenous). When grouped by age group, the majority of migrant farmers are under 35 years old (45%) and 38% are between 35 and 59 years old. Farmers over 59 years old are the least represented (9%). (Table 1). On the other hand, among the migrant natives farmers between 35 and 59 years old are the most important (54.5%).

Table 1 Socio-demographic characteristics of migrant producers

		Natives	Allochthonous	Allogeneous	X-squared	df	p-value
Age of the farmers	[18 -35]	23,6	50.6	57.6	28.173	6	8.72E-05
	]35 -59[	54,5	34.2	30.5			
	]59 +[	20	6.3	1.7			
	Nd	1,8	8.9	10.2			
Previous activities antérieure	Farmer	36.4	83.5	88.1	51.504	8	2.10E-08
	Craftsman	16.4	2.5	3.4			
	Trader	10.9	6.3	5.1			
	Employee	25.5	5.1	3.4			
	Retired	10.9	2.5	0			
Mode of land access	Purchase	13	42	45	18.74	2	8.52E-05
	Inheritance	87.8	9.8	2,4	55.073	2	1.10E-12
	Work-sharing	5.9	62.7	31,4	55.073	2	1.10E-12
	Gift	58.3	33.3	8,3	4.5	2	0.1054

Natives Non-natives Non-natives X-squared df p-value, Nd: person whose age is not determined

The farmers interviewed were divided into five socio-professional sectors before they settled in the department of Biankouma (Table 1). The majority were farmers (71.6%) and employees (12%). Retired people and artisans were the least represented with 4% and 2% respectively. Considering their origin, the same trend is also observed among

migrant natives. Among the Allochthonous and Allogenous, on the other hand, migrants are almost exclusively farmers and traders (Table 1).

With regard to the modes of access to land, four (4) modes were highlighted at the end of the surveys, namely: inheritance, purchase, gift and work sharing (Table 1). Purchase (51.5%) and work sharing (26.3%) were the main modes of access to land in the department. As for acquisitions by donation, only 6.2% of migrants are concerned by this modality. Purchase and work-sharing are the most widespread methods among Allochthonous and Allogenous migrants. As regards gifts and inheritance, the highest proportions were observed among natives migrants (Table 1).

3.2. Agronomic characteristics of cocoa plantations

The agronomic characteristics concerned the age of the plantation, the surface area, the previous crop and the type of crop practised. With regard to age, the study showed that the age of cocoa plantations varies from 6 months to 40 years with an average age of 7.8 years. These cocoa plantations are mainly in the active production phase which is between 5 and 15 years (58.8%) and young plantations less than 5 years old (26.8%). Plantations over 30 years old are the least represented (2.6%). This trend in the distribution of plantations according to the age is the same in all communities (Table 2).

The surface of the plantations varies from 0.25 to 17 ha, with an average of 3.18 ha. Analysis of the data showed that 43.3% of the plantations are less than 2 ha surface and 41.2% are between 2 and 5 ha. This trend in the distribution of plantations according to the surface is the same in all communities (Table 2).

Table 2 Agronomic characteristics of migrant farmers' plantations in Biankouma department

		Indigenous	Allochthonous	Allogenous	Statistics test
Age of plantations (years)	[0-5[27.3	31.6	20.3	X-squared = 13.426, df = 8, p-value = 0.09799
	[5-15[	50.9	54.4	71.2
	[15-30[	10.9	8.9	3.4
	30 +	7.3	0	1.7	
	nd	3,6	5.1	3.4	
Surfaces of plantations	≤ 2	50.9	43	37.3	X-squared = 2.9292 ; df = 6 ; p-value = 0.8177
	] 2-5]	36.4	41.8	45.8
	5 ≥	10.9	10.1	11.9	
	nd	1.8	5.1	5.1	
Previous crops	Forest	34.4	38.9	26.7	
	Fallows	18.4	51	30.6	
	Savannahs	16.1	45.2	38.7	
	Coffee	29.2	25	45.8	
	Cocoa	47.4	42.1	10.5	
	Rice	5.6	44.4	50	
Others crops	Cashew	24.3	44.6	31.1	
	Coffee	33.3	40.4	26.3	
	Rubber	57.1	28.6	14.3	
	Palm oil	50	0	50	

Six types of previous crops were identified during the surveys (Table 2). These are mainly forest (46.4%), fallow (25.3%) and savannah (16%). When considered individually, old plantations are the least represented (Table 2). The

plantations were, for the most part, established after forest clearing (34.4%) or were the result of the old cocoa farms replanting which the production is low (47.4%) among the Indigenous migrants. Among Allochthonous migrants, forests (38.9%), savannahs (45.2%), fallow land (51%) and old cocoa plantations (42.1%) were the main precedents for cocoa plantations, while among Allogenuous migrants, cocoa plantations resulted from the conversion of old coffee plantations (45.8%), rice plantations (50%) and savannahs (38.7%) (Table 2).

In addition to cocoa, four (4) other crops existed either in association or as pure crops. Coffee (58.8%) and cashew (38.1%) were frequently associated with cocoa. Rubber (ie Hevea) (3.6%) and palm oil (2.1%) were generally grown as pure crops. Concerning the different migrant communities, rubber and palm oil are the most practiced by Indigenous farmers, compared to cashew and coffee among Allochthonous farmers, and palm oil and cashew among non-Allogenuous farmers (Table 2).

3.3. Location of origin

Cocoa farmers from Côte d'Ivoire who migrated to the department of Biankouma come from 11 districts of the 14 districts in the country (Figure 2). The district of Montagnes was the main origin of migrants with 60% ; it was followed by the district of Bas-Sassandra (15%) and the district of Haut-Sassandra (8%). The town of Duekoué (11.8%) is the main origin of cocoa migrants farmers. It is followed by the towns of Biankouma, Vavoua (6.9%), Kouibly (5.9%) and Soubré (4.9%).

When considering the origin of cocoa migrant farmers, various origin can be noticed (Figure 2). Thus, indigenous farmers come from 27 localities out of the 55 localities that belong mainly to the districts of Montagnes (63.6%) and Abidjan (16.36%). The towns of Biankouma (44.82%) and Abidjan (16.82%) were the main origin localities. The Allochthonous cocoa farmers came from 32 localities the three main districts which are the district of Montagnes (39.24%), district of Bas-Sassandra (25.31%) and district of Vallée du Bandama (12.66%). The towns of Duekoué (15.18%) and Soubré (11.39%) had the highest rate of the interviewed persons (Figure 2). Among the Allogenuous coca farmers, the district of Montagnes was the main origin with 46.26% of the interviewed persons. It was followed by the districts of Haut Sassandra-Marahoué (26.66%) and Bas-Sassandra (15%). The towns of Duekoué (18.33%), Vavoua (15%) and Kouibly (13.33%) were the main origin localities (Figure 2).

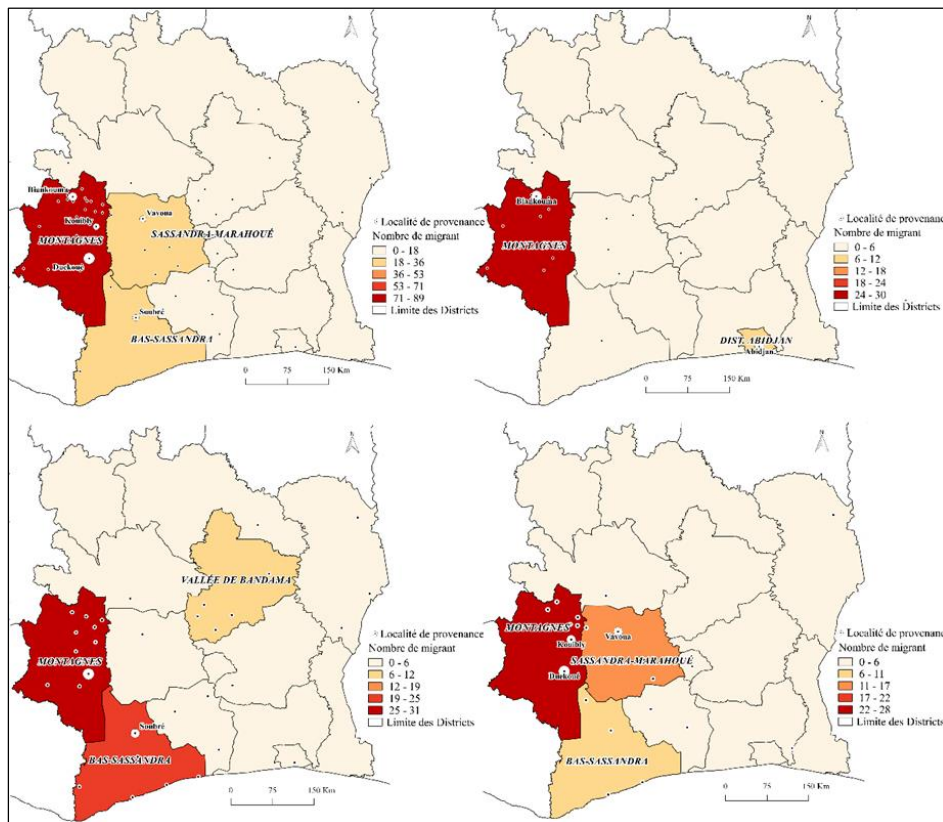


Figure 2 Origin of migrant farmers according to periods in a department of Biankouma

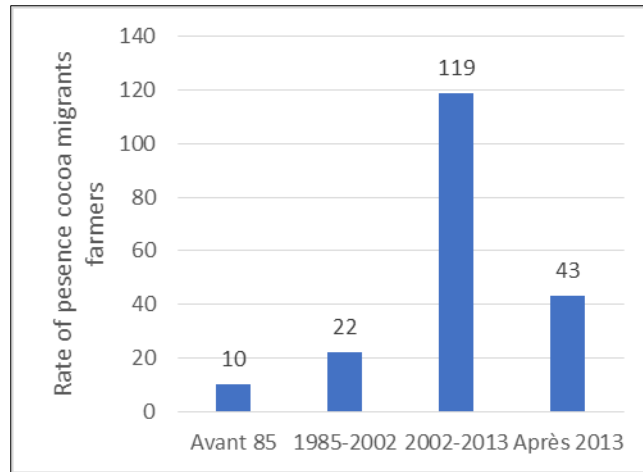


Figure 3 Rate of cocoa farmers according to the period of the installation in the department of Biankouma

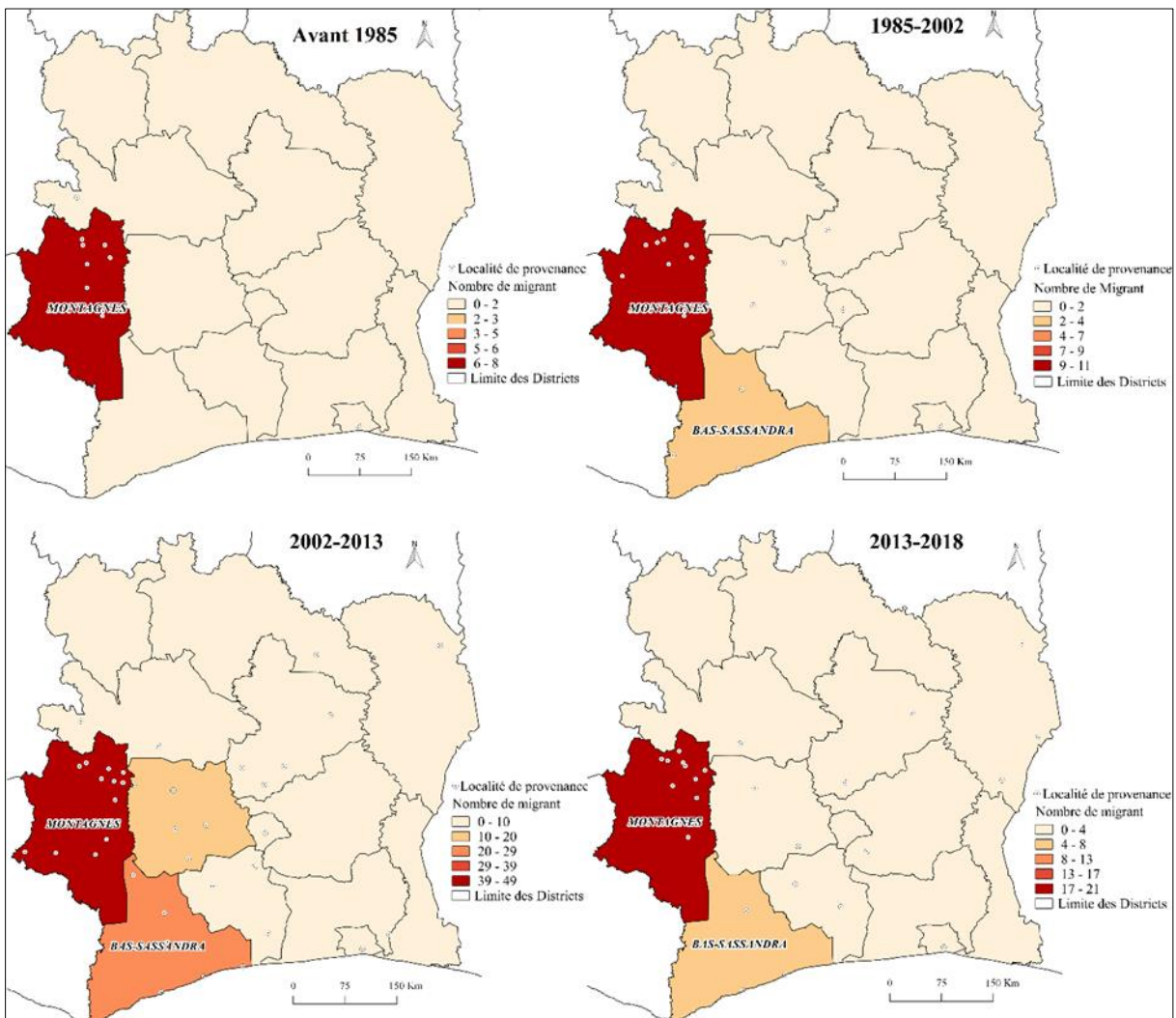


Figure 4 Maps of the settlement dynamics of cocoa farmers migrant in the district of Biankouma district

The arrival of cocoa migrants farmers in the district of Biankouman started in 1951 according to the realised interview. Four (4) main periods of installation of cocoa farmers were considered in relation to the cocoa economy migration (Figure 3). Considering all cocoa farmers, the largest wave of migration into the department of Biankouma was recorded between 2002 and 2013 (61.3%) (Figure 3). The lowest migration period was before 1985 (5.2%).

When combining the chronology of settlement and the origin of cocoa farmers, different trends can be observed (Figure 4). Before 1985, migratory movements came almost exclusively from the district of Montagnes (10%) in western Côte d'Ivoire. The period 1985 to 2002 was marked by the arrival of cocoa farmers from the neighbouring districts as Bas-Sassandra in the southwest with 22% behind the district of Montagnes. The period 2002 to 2013 was marked by the arrival of cocoa farmers from the district of Sassandra-Marahoué after the districts of Montagnes (39-49%) and Bas-Sassandra (20-29%). The period from 2013 to 2018 is dominated by the installation of cocoa farmers from the districts of Montagnes and Bas-Sassandra (Figure 4).

3.4. Relationship between socio-demographic and agronomic characteristics, and settlement dynamics

The hierarchical ascending classification (HAC) permitted to identify three groups of cocoa farmers (Figure 5). When considering the 18 variables, 15 were discriminating into different groups of cocoa farmers (Table 3). These include the age of the farmer, the origin, the installation period and cocoa as the previous crop. Three (03) variables did not contribute in the formation of these groups. These are coffee and cashew trees associated with cocoa trees and the coffee as a previous crop.

The first group (G1) is characterized by a high rate of Allogeneous cocoa farmers migrants (68.33%) and Allochthonous cocoa farmers (56.96%), whom the age was between 18 and 35 years, and who settled in the department of Biankouma between 2002 and 2013. They are ex-farmers (56.83%) who accessed land by purchase (60%) and worked-sharing (58.82%). Their cocoa plantations were installed in fallow land (81.63%), savannah (83.87%) and rice fields (77.77%).

The second group (G2) consisted of Allochthonous migrants (35.44%) whom the age is between 35 and 59 years and came from the district of Vallée du Bandama (72.72%). They were ex-farmers (30.93%) who settled in the department between 2002 and 2013 (32.77%) and accessed to the land through worked-haring (39.21%). Their cocoa plantations were established after cleared forest (56.66%). The size of their plantations are less than or equal to 5 hectares (45.45%).

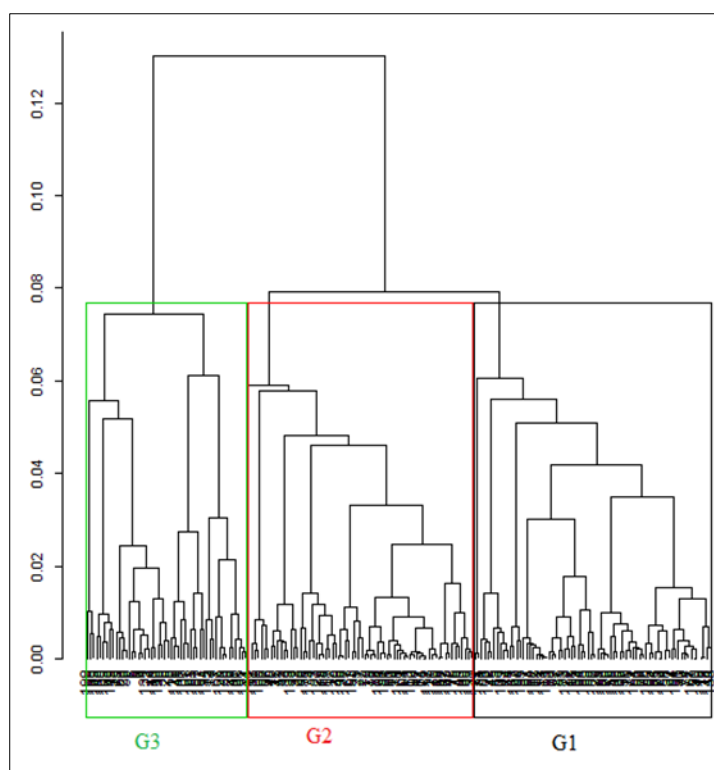


Figure 5 Hierarchical ascending classification showing different groups of cocoa farms

The third group (G3) composed of indigenous cocoa farmers (81.81%) whom the age is between 35 and 59 years (36%) and over 59 years (88.23%). They are generally ex-employees (70%), retirees (100%) and craftsmen (69.23%), came mainly from the Districts of Abidjan (90%) and Montagnes (33.33%). They returned to the region before 1985 (80%) and between 1985 and 2002 (82.36%). They accessed to land by inheritance (87.80%). Their Cocoa plantations are between 15 and 30 years (60%) and sometime than 30 years (80%) and were established on old cocoa farms (63.15%).

Table 3 Summary of characteristic variables of the different cocoa farms

Variables	Modalities	G1	G2	G3	Test of khi 2
Origin	Allochthonous	58.2	34.2	7.6	123.39***
	Allogenuous	63.3	36.7	0	
	Indigenous	9.1	9.1	81.8	
Socio-professional activities	Farmers	55.4	32.4	12.2	70.89***
	craftsmen	15.4	15.4	69.2	
	Trader	35.7	42.9	21.4	
	Employees	25	5	70	
	Retirees	0	0	100	
Purchasing	Purchase	58	32	10	28.72**
	Nd	33	23.4	43.6	
Inheritance	Inheritance	2.4	9.8	87.8	102.32***
	Nd	57.5	32.7	9.8	
Worked sharing	Worked sharing	60.8	37.2	2	21.13**
	Nd	40.6	24.5	35	
Installation period	2002-2013	52.1	35.3	12.6	74.74***
	1985-2002	0	13.6	86.4	
	After 2013	62.8	16.3	20.9	
	Before 1985	0	20	80	
Age of the cocoa farmer	[18 -35]	83.9	6.9	9.2	170***
	]35 -59[	0	64	36
	]59 +[	11.8	0	88.2
	Nd	93.3	0	6.7	
Origin	Abidjan	0	10	90	60.14***
	Lagunes	100	0	0	
	Woroba	33.3	16.7	50	
	Lacs	100	0	0	
	Zanzan	100	0	0	
	Vallée du Bandama	36.4	63.6	0	
	Montagnes	41.6	25.8	32.6	
	Sassandra-Marahoué	60.9	26.1	13	
	Goh-Djiboua	33.3	66.7	0	
	Bas-Sassandra	50	35.3	14.7	
Yamoussoukro	33.3	0	66.7		
Age of cocoa plantation	[0-5[53.8	19.2	26.9	24.44**
	]15-30[	26.7	13.3	60
	]5-15[	46.5	32.5	21.1
	30	0	20	80	
	nd	50	50	0	
Coffee associated	Coffee	45.6	28.1	26.3	NS
	Nd	46.2	27.5	26.2	
Cashew associated	Cashewr	50	27	23	NS
	Nd	43.3	28.3	28.3	
Fallow as previous	Fallows	81.6	0	18.3	38,03**

	Nd	33.8	37.2	29	
Old cocoa farm as previous	Old Cocoa farms	26.3	10.5	63.2	14.91*
Old coffee farm as previous	Old coffee farms	50	20.8	29.2	NS
Rice field as previous	Rice field	77.8	11.1	11.1	8.13*
Savannah as previous	Savannah	87.1	3.2	9.7	25.56**
Forest as previous	Forest	12.2	57.8	30	96.40***
Surface] 2-5]	47.5	31.2	21.2	13.02*
	≤ 2	45.2	22.6	32.1	
	≤5	27.3	45.5	27.3	
	nd	87.5	0	12.5	

Significance level of Chi-square tests: * < 0.05, **<0.01, ***<0.001; NS: Not significant; G: Group

4. Discussion

Analysis of the socio-demographic characteristics of the orchards showed that the production of cocoa in the department of Biankouma was done by Allochthonous farmers (38.3%) on the forest land and on mixed forest-savannah land. The Allochthonous farmers were more established on land forest land and on mixed forest-savannah land, where they converted a old coffee farms to cocoa plantations [16]. Indeed, in the face of the drastic drop of the coffee purchase to coffee farmers on one hand, and the increasing of the purchasing price of the cocoa since the beginning of the 1980s on the other hand [18], coffee farmers were increasingly turning to cocoa farming in order to ensure their financial stability [18, 19, 20]. However, the most presence of Allochthonous and Allochthonous coco farmers over the indigenous cocoa farmers points to a movement of people towards the department of Biankouma. Similar observations have been done in others cocoa production zones in South-West and Centre-West in Côte d'Ivoire [21, 22].

The age of cocoa plantations, which is between 6 months to 40 years, and the most presence of relatively youngest of the cocoa farmers whom age was under 35 to 45 indique the recent developping of cocoa crop in the departement of Biankouma. Others studies [21, 23, 24], revealed that young people in cocoa farming had to first work for the head of the family and get married, before obtaining an adult social status of an adult and being authorised to set up their own farm, either on the family land reserves or accessing land outside the family. Also, the relative youth of cocoa farmers confirms the distribution of different modes of access to land in the department. In fact, the access to the forest and forest-savannah transition lands, is due to the retrocession of the land from old coffee and cocoa plantations held by (indigenous) landowners to their descendants. According to Cissé et al., indigenous Dida cede their land mainly within the framework of lineage and rules imposed by the tradition [21]. However, the importance of purchase and worked-sharing revealed that these modes were the only for Allochthonous and Allochthonous cocoa farmers to access land because they are not landowners in the department of Biankouma. Previously, the savannah lands were unsuitable for cocoa farming, so are available and attract Allochthonous and Allochthonous farmers who settled there to experiment cocoa farming [25]. This situation could justify the high rate of accessing of plots by purchase.

The surface average observed throughout the department is 3.5 ha. Others studies [23, 26] in Kokumbo and in Abengourou revealed respectively a cocoa surface average of 3.2 ha and 10 ha. This result indicates on the one hand that cocoa cultivation is still carried by small family farms [27]. On the other hand, these small surfaces for many farmers could well be signs that the dynamics of cocoa extension have slowed down, or even stopped, facing the depletion of forest reserves in the department of Biankouma [28], which is why people are moving to the savannah [29]. Furthermore, this work revealed the low productivity in all vegetation types considered, with 141 kg/ha per year in the department. This yield value is lower than that obtained by [30, 31] which were around 390 kg/ha per year, and the national average which is 395 kg/ha [26]. The low productivity can be justified by the juvenile state of cocoa trees [32] and the resurgence of several diseases (brown rot, mirid and attacks of loranthaceae) recorded in 91% of plantations [33, 34, 35] could encourage cocoa farmers to also expand their plots beyond the rural domain, infiltrating protected areas, with preference for 'the forest' as a cultural precursor in all vegetation types. This observation was made in the

classified forest of Beki in the East of Côte d'Ivoire [3] and in the classified forest of Haut Sassandra in the West-Centre [36], where land saturation on the periphery of this forest has led populations to infiltrate it and installing vast cocoa plantations.

The analysis of the periods of the installing of cocoa farmers migrants in the department of Biankouma indicates that cocoa farming is recent in the study area as highlighted previous study [11] in Founbesso. These cocoa farmers invested forest land, as showed the preponderance of forest clearings to install cocoa crops in all considered vegetation types. The migration of cocoa farmers to the department of Biankouma began before 2000 in the forest land and forest-savanna transition land. It was a consequence of the migration policy adopted by the authorities, who advocated the free access to land. Thus, migrants from the savannah regions of Côte d'Ivoire and the northern border moved to create large plantations in the forest and transitional zones that were suitable to establish perennial crops such as cocoa [18]. These waves of migration can be also explained by the moving of populations of the centre of Côte d'Ivoire, composed majority of Baoule ethnic group, who moved following the flooding of their village by the Kossou dam lake water in 1970s. These two main factors constitute the triggering effects of the migration for cocoa farming in the department of Biankouma. However, that migration was localized only in the forest and the forest-savannah transition landscapes. But, between 2000 and 2013, the significant migratory flow observed in the different phytogeographical landscapes of the department of Biankouma during this period could be attributed to the various military and political crises that the country has experienced. That period was marked by a migratory flow of populations towards suitable areas for cocoa farming [37, 38]. In addition, the high rate of plantations whom the age was between 5 to 15 years confirms that the producing cocoa plantations in the department were established after the 2000s. The rush of cocoa farmers towards the savannah lands could be the result of a scarcity of forest lands. People have moved to colonize the unexploited agricultural land. According to Camara et al., in the savannah areas of Kédia in Cameroon and Bousédou in Guinea, the extension of agroforests had extended onto savannah land where the forest lands and fallow dense tree were reduced [29].

5. Conclusion

The study showed that the cocoa farming in the department of Biankouma was held in important part by the population of migrants such as Allochthonous and Allogeneous. Their population in the department increased considerably between 2002 and 2018, which corresponded the period of various socio-political crisis in Côte d'Ivoire.

In order to prevent a crisis linked to land conflicts in the region, the administrative authorities of the department should become more involved in land transactions between the chiefs of villages and migrants, by issuing legal documents.

The implementation of a model to determine the period of land saturation in the mountainous relief in the West of Côte d'Ivoire is necessary.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflicts of interest.

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