Chapter 2
Diversification of Cocoa Farms in Côte d'Ivoire: Complementarity of and Competition from Rubber Rent

François Ruf

> *Plantation crops seem to be superimposed on each other and, therefore, seem to be more complementary than competitive. Depending on the region, it is the autochthons or migrants who grow one or other of these perennial crops.*
>
> P. de la Vaissière, 1978, p. 105

In 1978, P. de la Vaissière noted the complementarity between perennial crops, at a time when land and forests were still abundant resources in Côte d'Ivoire. In the early 2000s, multinationals of the cocoa and chocolate sectors still expressed great confidence in the diversification and complementarity between perennial crops. They highlighted this as a necessity and professed a commitment to improving the living conditions of producers (Mehra and Weise 2007). While their objective was laudable, these multinationals did not seem to have yet grasped how village land and producers were being coveted by other sectors. It is only recently that they have started expressing private concerns regarding the supply of cocoa. Even though Côte d'Ivoire seems capable of producing more than one million tonnes of cocoa per year for several years yet, the producing countries as a whole do not seem to be in a position to meet the increasing global demand, estimated to rise by over 25 % (nearly one million additional tonnes annually) between now and 2020.

As far as large chocolate companies are concerned, the willingness to preserve diversification and complementarity at the scale of farms and producer countries has now been replaced by concerns about competition or even a trade war. 'My enemy is not my competitor in the purchase of cocoa, but the rubber industry,' said the representative of a large chocolate company at a conference in Abidjan in 2012. Whereas in the early 2000s, the chocolate giants refrained from any open criticism of public policy, some now refer openly to 'unfair competition'. In fact, for decades now, the tax on cocoa has amounted to almost 30 % of export prices against just 2 % on rubber. In Côte d'Ivoire, ongoing reforms, launched in 2012, should lead to a reduction in this gap but only marginally. Large chocolate groups are therefore

F. Ruf (✉)
UMR Innovation, Cirad-ES, TA C-85/15 (Bât. 15, Bur. 223),
73 rue Jean-François Breton, 34398 Montpellier Cedex 5, France
e-mail: francois.ruf@cirad.fr

F. Ruf and G. Schroth (eds.), *Economics and Ecology of Diversification*,
DOI 10.1007/978-94-017-7294-5_2

compelled to initiate new projects to assist farmers in order to boost cocoa production.

For their part, the rubber companies arrived in Côte d'Ivoire in the 1950s and 1960s, at a time when the country was completely ignorant of rubber. Then, in consultation with public authorities, they set up village projects to cultivate rubber. The first project to introduce and develop rubber cultivation in villages, of the order of 100 ha and covering 33 farms, was set up in 1968 and 1969 in Anguededou, near a large plantation established in 1966 by the government. In Côte d'Ivoire, this early model of private intervention in village agriculture remained specific to rubber; it was linked to this industry's particular history (Losch 1990). These projects were of modest size and seemed to remain marginal for a long time. But 30 years later, their effectiveness has proven to be remarkable (Chaps. 6 and 7). The discourse of rubber companies has become accommodative and sensitive to the interests of producers and competitors. 'Cultivation of rubber helps farmers climb out of poverty but we certainly do not want farmers to abandon cocoa and food crops,' says the director of one of the major rubber companies. But within the rubber sector, privatized and liberalized, they now find themselves lined up against each other, competing to encourage farmers and upper middle class investors (UMCI[1]) to plant rubber or to expand their own rubber estates.

The theme of diversification, when combined with institutional changes in relationships between family farming, industries, governments, the elites or the urban bourgeoisie, therefore represents considerable economic and political challenges. One can hypothesize that training, technological innovation and capital in the form of projects is beneficial to family farming. When unaided, family farming is based primarily on factors of labour, land and forest, with little capital other than that created by the planted and cultivated crop. In other words, the scarcity of land, forest and labour resources introduces a new dimension to diversification: beyond a few cases of land grabbing, farmers—diversifying in a context of limited land and labour resources—encourage agro-industrial groups to increase their support to producers in order to counter competing operators and sectors. This has become a new determinant of diversification.

It is therefore extremely important to evaluate and understand the processes of diversification in a country whose resources of rural populations, labour, land and forests are not inexhaustible. The diversification model proposed in this book's introduction emphasizes ecological change after a few decades of quasi-monoculture. Is it also the primary determinant of diversification for the world's leading producer of cocoa? In addition to factors of price and public policy (for example, the creation of a hybrid oil palm sector in the 1960s), has not the process of diversification also been driven by deforestation and exhaustion of the forest rent, in connection with the procurement strategies of large private groups?

This issue has partially been addressed in the economic literature. In various small regions, the diversification towards oil palm, rubber and annual crops—such

[1]For a definition of UMCI, see Footnote 3 in the Chap. 1.

as cassava and pineapple—is already being interpreted as stemming from the exhaustion of forest rent. It has been facilitated by opportunities that projects and investments offer (Ruf 1987, 1993; Chauveau 1993; Colin 1990a, b; Mollard 1993; Oswald 1997; Léonard 1997; Naï Naï et al. 2000; Léonard and Vimard 2005).

But even more than these observations, which are limited to the local scale, the link between the difficulty of replanting cocoa, public policy and diversification deserves assessment at the national level. What has exactly transpired in the coffee sector? What are the main dynamics of agricultural diversification in the country's cocoa cultivation zone, when considered region by region?

How to understand and evaluate this process of diversification at the national level? The issue of intensification associated with diversification after exhaustion of the forest rent has been little discussed. Can we support a hypothesis of an innovation-diversification-intensification process involving resorting to an increase of labour and capital to replace the land factor? Any innovation-diversification which requires extra labour to deal with the degradation of the environment and to raise production falls under the ambit of a classic and neutral Boserupian process in terms of land consumption, whereas any innovation-diversification which calls for additional inputs and capital can said to be part of a 'modernized' Boserupian process (Couty 1989). In this latter case, the substitution of capital for land and labour will increase productivity as compared to these two factors—a decisive progress since they are become limiting factors in Côte d'Ivoire.

It can also be that diversification is part of an extensification process, by reducing the requirement of labour and increasing the consumption of land. In this case, the process moves away from Boserupian models and increases competition between crops and between sectors, especially at the expense of employment. How to analyze the process of diversification of cocoa towards oil palm and especially towards rubber? Finally, authors such as Jacques Weber show us that these innovation-transitions do not take place as a matter of course. Other than the government and large private groups, who are the family-farming actors driving these transitions?

2.1 Methodological Elements

We first rely on a survey conducted in 2006 over 3 months of a total of almost 1100 farms spread out over 13 administrative regions, 25 *départements* and more than 50 villages. This sample is constructed based on regional averages of the 2001 national agricultural census (NAC) of Côte d'Ivoire, by taking a proportionate number of farms by region on the basis of cultivated areas by crop (Table 2.1).

Of the 14 regions within the forest zone, considered to be part of the cocoa-coffee area (south of the Zanzan region), only the Montagnes region could not be included in the survey. The sampling does not claim absolute statistical representativeness within each *département*. Indeed, a compromise had to be made between statistical rigour and a cost/effectiveness balance, by choosing to limit the number of villages

Table 2.1 Distribution of cultivated areas of cocoa and coffee by *département* in 2000, according to the 2001 national agricultural census

Administrative regions in 2001	Cocoa and coffee crop areas (ha)			
	Cocoa	Coffee	Total	%
Bas-Sassandra (7)	535,267	62,800	598,067	25.13
Haut-Sassandra (9)	214,847	94,740	309,587	13.01
Sud-Bandama (6)	163,635	34,074	197,709	8.31
Moyen-Cavally (13)	104,445	84,946	189,391	7.96
Agneby (2)	133,594	43,485	177,079	7.44
Montagnes (14)	64,072	89,459	153,531	6.45
Moyen-Comoé (3)	125,977	23,573	149,550	6.28
Fromagers (8)	101,658	22,441	124,099	5.22
Sud-Comoé (1)	67,092	54,748	121,840	5.12
Lagunes (5)	87,065	31,551	118,616	4.98
Marahoué (10)	80,529	17,086	97,615	4.10
Lacs (11)	69,908	19,007	88,915	3.74
N'Zi-Comoé (12)	19,117	13,882	32,999	1.39
Zanzan (4) and northern regions	10,344	10,283	20,627	0.87
Total	1,777,550	602,075	2,379,624	100

Source Ministry of Agriculture, NAC 2001

Data 830 ha surveyed, apart from the 230 ha of coconut, and about 80 ha for which farmers did not know the previous crop because the plantation was purchased or inherited

to between three and eight per region. But on the whole, the quality of data and the geographical and ethnic diversity of the surveyed zones allow the main trends in each of the 13 administrative regions to be clearly discerned. Through aggregation, the dynamics at the country level were also assessed in 2006.

Then in 2008, we conducted a fresh survey of a total of 435 farms distributed over 8 of these regions, 12 *départements*, and 30 villages in the coffee and cocoa production area. These data were partially updated in 2010. As in 2006, the sampling criteria only chose family farms. The survey teams were able to contact only those farm managers present in the village. Consequently, these two studies do not include 'absentee' farmers and UMCIs living in towns. But another survey, conducted specifically with UMCIs of the Agneby region sheds light on these actors who have acquired a specific significance in the rubber sector.

Finally, in 2010 and 2011, we began to update the data in a few villages. The regions of Cavally and Montagnes were not sufficiently open to allow quantitative surveys, but we were nevertheless able to make some observations.

The official presentation of the 2001 National Agricultural Census includes a long history of 'coffee-cocoa combination' in which these crops seem inextricably linked at the regional and farm scales. According to this census, coffee was still being cultivated on 600,000 ha. But during the 2000s, this representation will turn into a myth. Indeed, the decline of coffee, already begun in the 1980s, will accelerate and contribute significantly to diversification towards oil palm and, later, towards rubber.

2.2 Plantation Dynamics by Administrative Region in 2006

2.2.1 Sud-Comoé

2.2.1.1 Diversification Towards Oil Palm Brought on by Public Policies

In the 1980s, Sud-Comoé, especially its Aboisso *département*, was an area known for its coffee cultivation, then for oil palm development thanks to public policies. Indeed, a second oil palm plan was implemented by the government from 1985 to 1990, particularly in the Aboisso sector (Chap. 4). Oil palm became the dominant crop in the 1980s, and especially so in the 1990s following a second wave of adoption of oil palm cultivation, this time without project support (Fig. 2.1).

2.2.1.2 Diversification Encouraged by the Market, Deforestation and Interests of Labourers

During the 2000s, oil palm continued to be planted despite falling prices of palm bunches. In addition to the ability of family farming to persevere for several years in the hope of an increase in prices, the relative persistence of investments in oil palm in this region was due to:

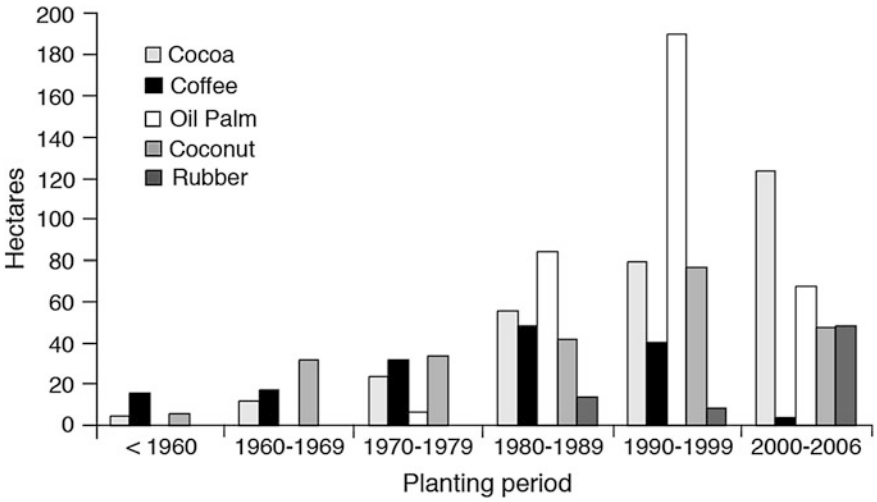

Fig. 2.1 Age structure of perennial crops in the Sud-Comoé region, Côte d'Ivoire, in 2005–2006. (*Sources* Data collected by CIRAD in 2006 on behalf of the European Union, in Ruf 2006a; one-time survey)

- information gained on hybrid oil palm through the project. The second oil palm plan of the 1980s was active in this region and many UMCIs took advantage of it. Village farmers from outside the area also did so. There is quite a bit of knowledge on cultivating hybrid oil palm in this region (Chap. 4);
- the domestic and regional market for red oil (African oil);
- the market for palm wine at the end of the oil palm life cycle. The possibility of obtaining immediate capital by felling the oil palm tree, or rather by negotiating its sale to a team of fellers-extractors-distillers is the great advantage of oil palm in West Africa. It accords flexibility to the farmer since he can count on acquiring capital at the end of the oil palm life cycle. Indeed, the farmer has the option to shorten the life of a part of his oil palm plantation in an emergency;
- ecological change, i.e., the aging of coffee and cocoa trees and lower yields;
- the role of labour and sharecropping employment contracts. Even if farmers were reluctant to diversify and convert old plantations, the labourer situation brought them back to reality. Starting in the 1980s, farmers began finding fewer and fewer candidates to take over their old coffee plantations under the abusa contract, a form of sharecropping with production sharing between the 'taker' (1/3rd of the product) and the owner of the plantation (2/3rd of the product). Also a factor was the abandonment of old cocoa plants by labourers looking instead for oil palms under the abusa contract.

2.2.1.3 Survival of Some Coffee Plantations, Competition from Rubber, Planting-Sharing Contracts

There are few plantations left of coffee, the first of the major crops; they have been partly replaced by oil palm trees. Rubber, introduced in the 1980s, became popular in the 2000s and began to compete with oil palm because of the rise in rubber prices. In conjunction with the increasing adoption of rubber cultivation, there was a simultaneous development of the advent of new actors (retirees and UMCIs, even religious groups) and an institutional innovation: the 'planting-sharing' or 'working-sharing' agreement. This is an arrangement between an owner turning over his land to a 'taker' who clears and cultivates the land. They then share the cocoa, oil palm or rubber plantation when it goes into production (Colin and Ruf 2011).

2.2.1.4 Local Dynamism of the Coconut Sector

Coconut cultivation, concentrated on the coast, extends a few kilometres inland. Even though it is a little over-represented in the sample, there is indeed a dynamism to the coconut sector. Plantations are being established in large numbers even outside coconut programmes launched by Sodepalm in the 1970s. In fact, a market exists due to a mature-coconut sector involving Ivorian, Ghanaian and Nigerian buyers.

2.2.1.5 Cocoa Cultivation in Expansion in the East of the Country

Surprisingly, cocoa cultivation continues its expansion in the east of the country, especially in the east of the *département*, between Mafere and the Ghanaian border, where there were forests yet to be cleared during the 2000s. Several villages and farmers of this region do not even cultivate oil palm; they are specializing once again in cocoa cultivation.

2.2.1.6 Replantation, Diversification and Expansions

This former plantation area is therefore dynamic. In addition to its high level of diversification, the plantations here are relatively young. Taking all perennial crops together, more than half (688 ha) the plantations were established in the 1990s and 2000s of the 1111 ha identified in the 2006 sample.

Even ignoring the role played by public policies in initiating oil palm diversification, this Sud-Comoé region perfectly illustrates a dual process linked to the cocoa cycle (Table 2.2):

- replanting-diversification of the initial—and now aging—cocoa and coffee plantations, conversion to oil palm and rubber;
- expansion of cocoa plantations by forest clearing, on agricultural frontiers, on the outskirts of cultivated areas.

This dual process helps limit the age of cocoa trees to 25 years instead of 35–40 years. The oil palm tree can be felled at 10 or 15 years (instead of 25) if the farmer needs money.

2.2.2 Agneby

The situation in Agneby is similar with respect to the age of plantations. Villagers surveyed in 2006 in Agneby had almost no plantations that were established before

Table 2.2 Crops preceding perennial crops in Sud-Comoé

Crop	Preceding crop (ha)					
	Forest	Fallow	Old coffee plants	Old cocoa trees	Oil palm	Total
Coffee	116 (78 %)	3	26	3	0	148
Cocoa	224 (76 %)	7	23	31	8	293
Oil palm	79 (24 %)	49	85	30	82	324
Rubber	12 (19 %)	19	12	9	13	65
Total	431	78	146	73	103	830

Sources CIRAD and A&C-Vie surveys on behalf of the EU in 2006
Data 830 ha surveyed, apart from the 230 ha of coconut, and about 80 ha for which farmers did not know the previous crop because the plantation was purchased or inherited

1970. Coffee plantations of the 1950s and 1960s, the dominant crop of the time, were abandoned or succumbed to the fires of 1983. Others had been converted into cocoa plantations by second generation autochthons, subsequent to the purchase of old coffee plantations by migrants through local land markets. In 2006, the conversion of coffee plantations to those of cocoa which began in the 1970s reached its peak. This took place most notably through the process of sale by the autochthons of old coffee plantations and forests to migrants. Also worth noting is the entry of migrants in protected forests, such as that of Kavi, near Agboville.

As far as family agriculture is concerned, Agneby remained very little diversified in 2006; it relied heavily on cocoa, with coffee surviving in a few outposts. Here, too, a return to cocoa by migrant farmers was observed; they had started with Poyo banana plantations, near the railroad but they finally abandoned this sector because of lack of market access.

2.2.2.1 Investments in Cocoa Plantations

The dominant profile of such a region is therefore the consistency and regularity of investments in cocoa, with new plantations regularly being set up between 2000 and 2005. The total of new areas devoted to cocoa in 6 years is close to the investments made in the 1990–1999 decade. This is amazing for an 'old' plantation zone and confirms the revival of cocoa cultivation in the country's east in the 2000s (Fig. 2.2).

During the 2000s, the revival of cocoa cultivation depended, for the most part, on the clearing of secondary forests. We also observed the recourse to the technique of coppicing—requiring less labour and effort than replanting—favoured by the older farmers. In 2006, rubber was only just emerging, but already this crop was

Fig. 2.2 Age structure of perennial crops in the Agneby region, Côte d'Ivoire, in 2005–2006

seen by the farmers as a solution to the problems of replanting cocoa. It is often used as a relay crop on a plot of old cocoa trees: a form of an agroforestry technique, where interplanting between two perennial crops is just a transition between two phases of monospecific plant stands.

2.2.2.2 Rubber Smallholders and UMCIs

Even though family agriculture ventured into rubber cultivation only in 2006, Agneby, near Abidjan, was one of the most coveted regions by UMCIs to set up plantations ranging in size from several tens to several hundreds of hectares. In 2008, the mapping of about 50 plantations owned by UMCIs around the village of Offumpo, 20 km from Agboville, provided insight into the pressure that these new actors are exerting on village lands. This intrusion of UMCIs into village land holdings laid the seeds of future conflicts over land. There were, however, also positive aspects to their arrival, especially the establishment of contacts and exchange of information between farmers and managers of plantations owned by UMCIs, thus facilitating the adoption of rubber cultivation by the villagers.

2.2.3 Moyen-Comoé

In Moyen-Comoé, the situation was observed to be similar to those for the previous two regions. These three regions are part of the large south-eastern region of the country.

- There was a similar rate of cocoa plantations, here with a little more 'cocoa-after-cocoa' replanting. But it was observed that for as much as 63 % of the area, the preceding crop was 'forest' (Table 2.3).
- A relative strength of coffee cultivation well into the 1990s, in part thanks to the peak prices attained in 1994–1995.

Table 2.3 Crops preceding perennial crops in Moyen-Comoé

Crop	Preceding crop (ha)					
	Forest	Fallow	Old coffee plants	Old cocoa trees	Oil palm	Total
Coffee	50 (46 %)	3	34	21	0	108
Cocoa	258 (63 %)	16	25	109	3	411
Oil palm	1 (5 %)	0	0	7	2	10
Rubber	8 (7 %)	41	10	50	0	108
Other	4 (27 %)	0	9	0	0	13
Total	320	60	77	187	5	649

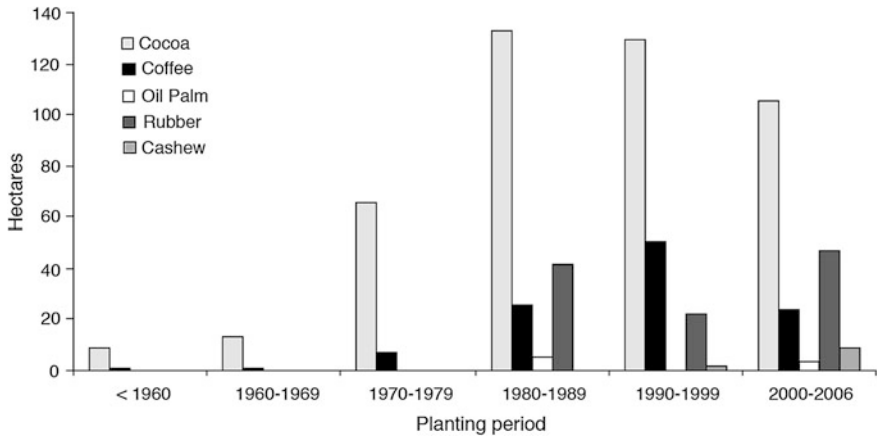

Fig. 2.3 Age structure of perennial crops in the Moyen-Comoé region, Côte d'Ivoire, in 2005–2006

Rubber cultivation began here earlier due to favourable public policy and a project set up in Bettié. After that, it took almost 10 years for independent rubber cultivation—outside projects and without government support—to regain momentum (Fig. 2.3). Almost all rubber plantations were established after clearing old cocoa or on fallow (Table 2.3). The cashew plantations made a hesitant appearance in the 2000s, partly for the good market for the crop, partly for its resistance to drought and fire. Rubber and cashew clearly represent the dimension of ecological change among the major determinants of diversification.

2.2.4 Zanzan

With a relatively dry climate, the Zanzan region, also to the east but further north, was more affected than other regions by the drought years, especially by the 1983 fires that destroyed hundreds of hectares of cocoa plantations. Ecological change here clearly determines the process of diversification, with:

- the marked decline of cocoa cultivation;
- the rise of cashew with 95 % of orchards being planted on fallow land (partly created by the burning down of cocoa plantations), after the clearing of old coffee plants and, to a lesser extent, after the felling of old cocoa trees (Table 2.4, Fig. 2.4).

Also observed in 2006 was the survival of old coffee plantations from the 1960s, partially spared by the devastating fires of 1983. This was probably why they have been maintained. After the fires, farmers still needed some coffee to survive.

Table 2.4 Crops preceding perennial crops in Zanzan

Crop	Preceding crop (ha)				
	Forest	Fallow	Old coffee plants	Old cocoa trees	Total
Coffee	16.8 (61 %)	9.8	0	0.5	26.5
Cocoa	56.3 (95 %)	1.5	0.5	1.0	59.3
Oil Palm	0	2.0	0	0	2.0
Rubber	0	0	4.0	0	4.0
Cashew	6.0 (6 %)	54.0	27.5	6.0	93.5
Orange	0	1.3	0	0	1.3
Total	78.5	68.5	32.0	7.5	186.5

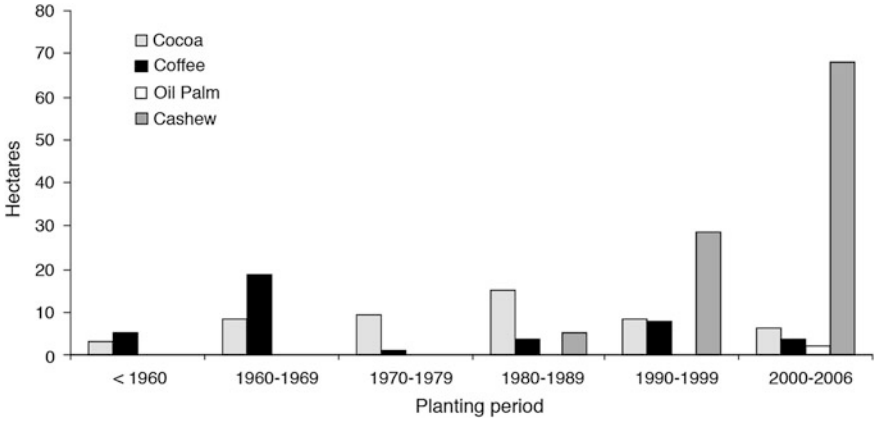

Fig. 2.4 Age structure of perennial crops in the Zanzan region, Côte d'Ivoire, in 2005–2006

2.2.5 Lagunes

Located in proximity to the Abidjan markets, Lagunes was recognized as a major cocoa production region. But it was also known for its natural oil palm groves still abundant as recently as the 1950s. Early on, this region benefited from the public policy in the form of the first oil palm plan (1960s) and the first experiments in village rubber plantations (1970s). Thus, the Lagunes region, especially its *département* of Dabou, has every reason to be called one of the most diversified areas of Côte d'Ivoire. In 2006, no trace remained of the oil palm trees of the 1960s and 1970s or even of the 1980s; they were all felled and converted into palm wine (Fig. 2.5).

Each decade saw here a dominant crop:

- 1970s: cocoa;
- 1990s: oil palm, in general, replacing coffee;
- 2000s: rubber.

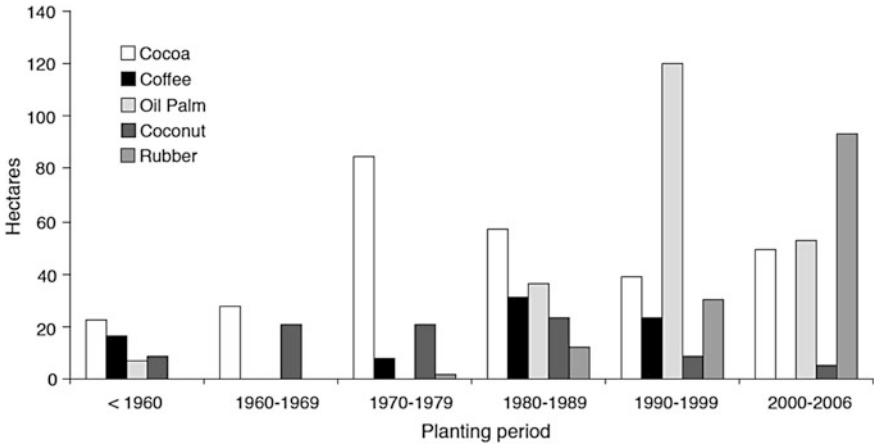

Fig. 2.5 Age structure of perennial crops in the Lagunes region, Côte d'Ivoire, in 2005–2006

A bit like in the Sud-Comoé region, the decline of the old coffee-cocoa combination in favour of the new rubber-oil palm combination is explained by the conjunction between, on the one hand, deforestation and environmental degradation and, on the other, new opportunities provided by markets and favourable public policies. Do the developments in these two regions presage the future of the whole of Côte d'Ivoire?

2.2.6 Sud-Bandama

The Sud-Bandama sub-sample is limited to 36 farms, whence a limited representativeness. The importance of oil palm is enhanced by the proximity of the factory of the Palmci group. Nevertheless, the trend of declining cocoa, offset by a rise of oil palm in the 1990s, is very real (Fig. 2.6).

The prominence of the oil palm stems partly from a dual marketing network which reduces market risks:

- the Palmci factory. During the 2000s, as in other regions such as Sud-Comoé (Adiake) and Sassandra, its effectiveness suffered due to transport problems and a shortage of trucks;
- the artisanal sector for red oil and Kabakrou soap (literally soap-stones). It offers reassurance to farmers because of its market security and regularity, and the economic balance that is created within the family. In this sector, women play a leading economic role. Not only do farmers' wives themselves produce and process the oil, the traders from Divo who come to buy it are also mainly women.

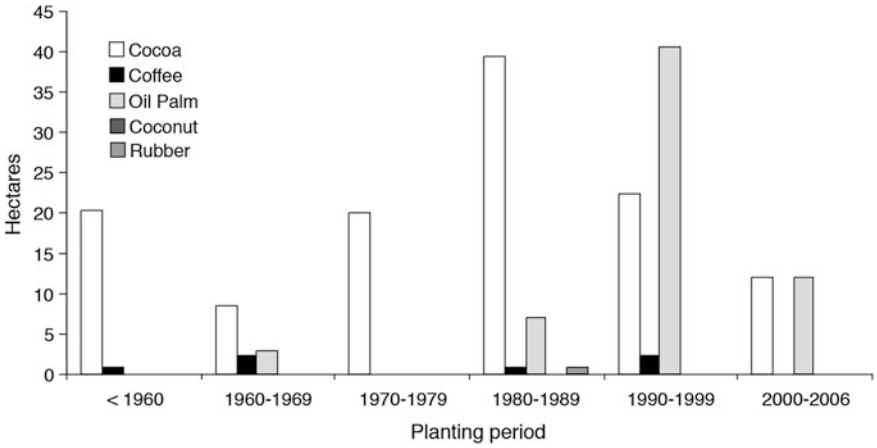

Fig. 2.6 Age structure of perennial crops in the Sud-Bandama region, Côte d'Ivoire, in 2005–2006

However, in addition to price and market factors and public policy, palm diversification was here too accelerated by ecological change and progression of the cocoa life cycle (Table 2.5): the 1983 fires destroyed thousands of hectares of cocoa plants. After a few years, farmers replanted cocoa but encountered the difficulties of doing so in a degraded environment. They thus seized the opportunity to cultivate oil palm instead.

This process of diversification and conversion occurred over a time span which was longer than 50 years and, therefore, over three generations. In a simplified manner, we can say that the grandfather was a coffee grower, the father cultivated cocoa and the son planted oil palm. Very likely the fourth generation will choose rubber.

2.2.7 *Bas-Sassandra*

In this region, which encompasses the three *départements* of Soubré, San Pedro and Sassandra, soils are better suited to coffee cultivation than to cocoa cultivation. As recently as 1970, the area was still covered by rainforest. Forest rent and attractive

Table 2.5 Crops preceding perennial crops in Sud-Bandama

Crop	Preceding crop (ha)					
	Forest	Fallow	Old coffee plants	Old cocoa trees	Oil palm	Total
Coffee	4.0 (80 %)	0.3	0	0.8	0	5.0
Cocoa	34.5 (40 %)	8.0	16.0	28.0	0	86.5
Oil Palm	4.0 (8 %)	22.5	6.5	17.0	1.0	51.0
Rubber	2.0 (50 %)	0	0	2.0	0	4.0
Total	44.5	30.8	22.5	47.8	1.0	146.5

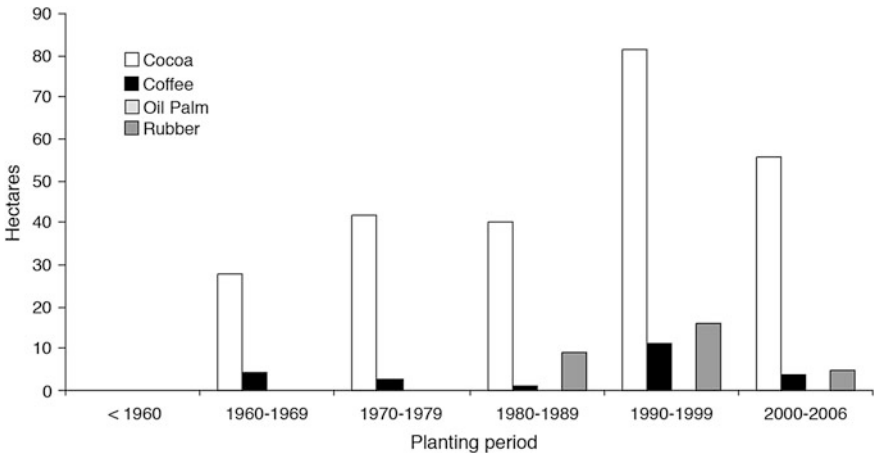

Fig. 2.7 Age structure of perennial crops in the Bas-Sassandra region, Côte d'Ivoire, in 2005–2006

cocoa prices drove cocoa cultivation to prominence from the 1980s to 2000, attracting hundreds of thousands of migrants (more than 20 % annual population growth in the 1970s and 1980s). After cocoa cultivation peaked in the 1980s, a decline in investment in cocoa plantations was observed (Fig. 2.7). The main reasons were land scarcity, loss of forests and its consequences, drop in fertility, increase in pests like termites, all leading to difficulties in replanting.

Farmers began diversifying in the 1990s, first gravitating towards oil palm then to rubber, thanks to public projects or private companies. In addition to assuring a market, projects also helped bring in information on new crops and supply planting material, often the key to investment. In addition to these project opportunities, the first cases of early mortality of cocoa around San Pedro also contributed to the adoption of rubber in the 1990s.

In the *département* of Sassandra, citrus cultivated for essential oil—a crop grown earlier by European planters—saw some development in the 1990s. In 2006, however, the crop became a casualty of the processing factory's closure.

Finally and most importantly, the adoption of rubber cultivation by the villagers was initiated by relatively modest local projects set up by rubber companies in the 1980s. In 2006, rubber was mainly visible along roads, but little inland yet. However, it was obvious that it held a promising future. This is one of the regions that will see an extraordinary acceleration of the adoption of rubber cultivation in the early 2000s, on the outskirts of private estates that provided help to the villagers.

Chocolate companies also helped cocoa farmers effectively through development projects and through certification schemes, which resulted in some technical support and better prices. But in this big region, especially in the San Pedro *département*, diversification into rubber seemed irreversible, sometimes indistinguishable from conversion from one monocrop to another.

2.2.8 Fromager

In the Fromager region, some villages benefitted from a rubber project which was set up in the early 1990s. In these villages, rubber cultivation brought economic success to farmers and spread through imitation (Ruf 2012). However, the *département* remained fundamentally cocoa oriented, with renewed investments in the 1990s and 2000s, at least until 2006 (Fig. 2.8).

In the 1960s and 1970s, coffee cultivation declined and then disappeared altogether. Burned or abandoned, it was first replaced by cocoa and then by rubber. As in other regions, there was a revival in the 1990s thanks to the rise in coffee prices in 1994–1995 and efforts undertaken by agricultural extension. But this recovery did not last long.

2.2.9 Haut-Sassandra

In 2006, the region of Haut-Sassandra, especially the area around Daloa, exhibited a greater resilience of the coffee sector than elsewhere, but the rapid decline of investments in coffee cultivation was similar to that in other regions. Here too, despite a timid emergence of cashew and teak in 2006, it was cocoa that benefitted from coffee's decline (Fig. 2.9).

2.2.10 Marahoué

In 2006, Marahoué was still an 'all-cocoa' region. Here too, there was a revival in investments in the 2000s, after the downward trend experienced in the 1980s due to

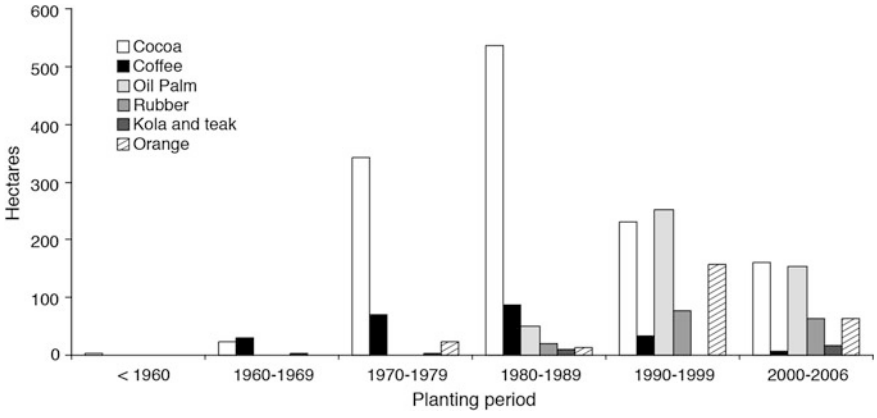

Fig. 2.8 Age structure of perennial crops in the Fromager region, Côte d'Ivoire, in 2005–2006

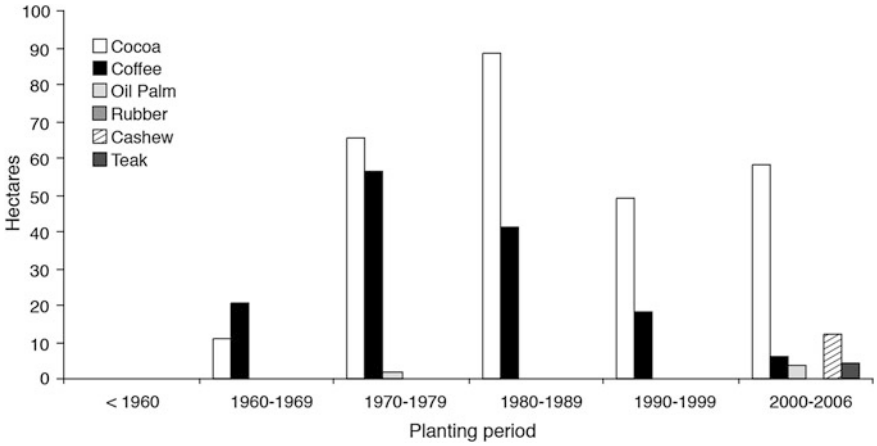

Fig. 2.9 Age structure of perennial crops in the Haut-Sassandra region, Côte d'Ivoire, in 2005–2006

scarcity of land. In addition to the rise in producer prices in 1997–1998, generation change and the subsequent increase of labour and energy played an important role. All the children who came with their parents in the 1980s were in their 30s in the 2000s and found solutions in order to be able to plant and replant.

Nevertheless, Marahoué, once known for its high yields post-forest-clearing, suffered from the decline of production and lower revenues. Cocoa farmers became poorer. The swollen shoot virus was at its peak. Under the impact of environmental change, this region became a candidate for diversification, particularly towards rubber, and saw the emigration of its youth to other regions (Fig. 2.10).

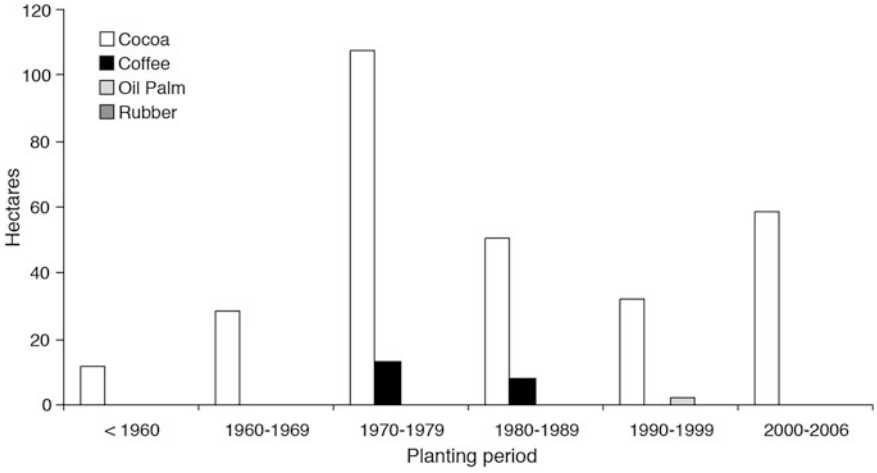

Fig. 2.10 Age structure of perennial crops in the Marahoué region, Côte d'Ivoire, in 2005–2006

2.2.11 Lacs: The Return to the Village in the 2000s

Prior to the surveys, we assumed that Lacs was a highly diverse region which was moving away from cocoa. This assumption was contradicted by the facts. In 2006, we observed instead a return to cocoa, in every sense of the term: not only a return of investments, but also return of many migrants to their home villages. They were both disappointed by the decline in production in the west of the country where they had migrated to and concerned about the crisis the country was going through (Fig. 2.11).

2.2.12 N'Zi-Comoé: The Revival of the Cocoa Belt Until 2006

The N'Zi-Comoé region was the country's major 'cocoa belt' in the 1950s and 1960s. Its decline began in the mid-1970s, so much so that, in 1979, the then Agriculture Minister, M.D. Bra Kanon, commissioned a study from the research station in Bingerville in charge of cocoa (formerly IFCC-IRCC) to analyze the reasons of this decline. Based on the knowledge of the region, J.M. Gastellu (researcher at Orstom—now IRD) quickly identified the factors responsible. Côte d'Ivoire then began to re-experience the process of migration of farmers from the old planting areas to forests. These new lands were sought by farmers both for the possibility of farming larger areas than in their original farming locations as well as for the good cocoa yields guaranteed by the forest. Production of the old cocoa belt then began to decline because of aging plantations, climate change and decreasing yields (IRCC 1979; Gastellu 1979, 1982; Ruf 1984).

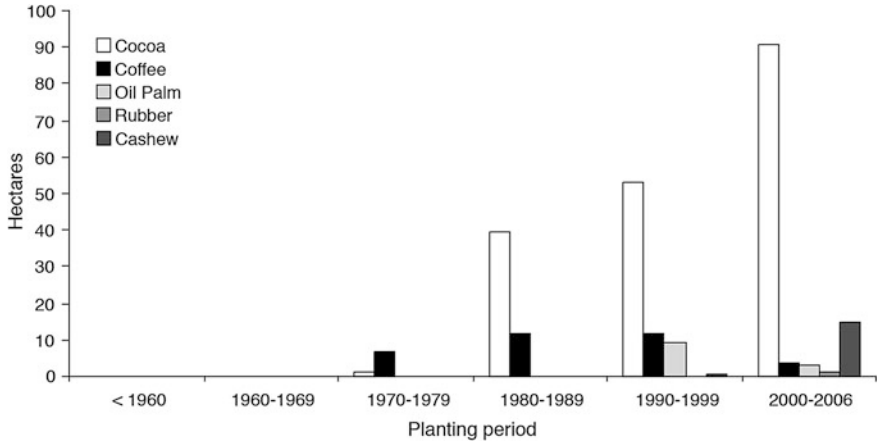

Fig. 2.11 Age structure of perennial crops in the Lacs region, Côte d'Ivoire, in 2005–2006

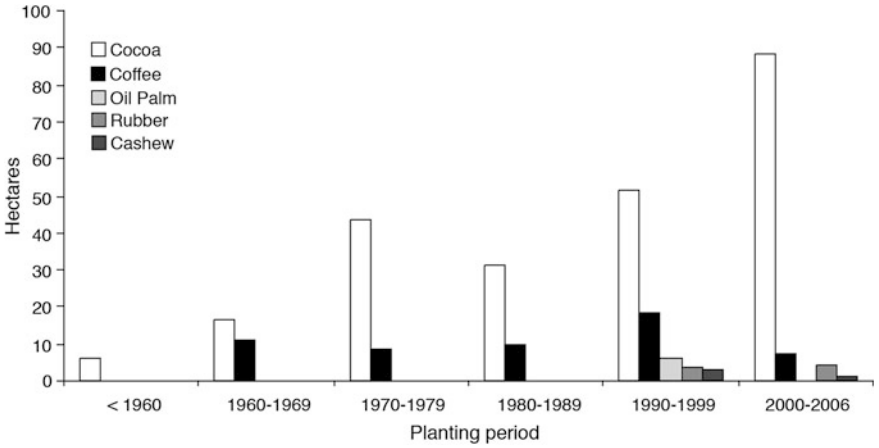

Fig. 2.12 Age structure of perennial crops in the N'Zi-Comoé region, Côte d'Ivoire, in 2005–2006

In the 1970s, migration from N'Zi-Comoé to nearby forests in Moyen-Comoé (near the border with Ghana), in Agneby and particularly in Bas-Sassandra emptied the old cocoa belt of a large part of its workforce, both autochthons and migrants. Workers and Abusan foreigners accompanied these flows, with growers lamenting the lack of labour (Gastellu 1979). As for the Lacs region and its workforce, this exodus of the 1970s and 1980s led to a regrowth of wild vegetation similar to forests on abandoned plantations and fallow land in the 1990s and 2000s. It is these secondary forests which were once again cleared for cocoa: in part by 'emigrants' returning to their villages of origin, but mainly by a second generation, the sons of emigrants or of those who had never left the village. This return to the source of cocoa shows clearly the process of shifting cultivation which applies to a so-called perennial crop at the national level.

Throughout this period, rubber cultivation was still barely visible. It was only from 2005–2006 onwards that rubber cultivation was adopted to replace this revival of investments in cocoa, but this mainly benefitted the UMCIs in Abidjan (Fig. 2.12).

2.2.13 Moyen-Cavally

Much like Bas-Sassandra and Haut-Sassandra, the name of the Moyen-Cavally region comes to mind as one of the hotspots of cocoa migration of the 1980s and 1990s. Migrants arrived in their thousands annually. In 2006, there was still a substantial amount of coffee cultivation, here too because of the relative unsuitability of soils for cocoa cultivation. Initially, migrants attempted to grow both

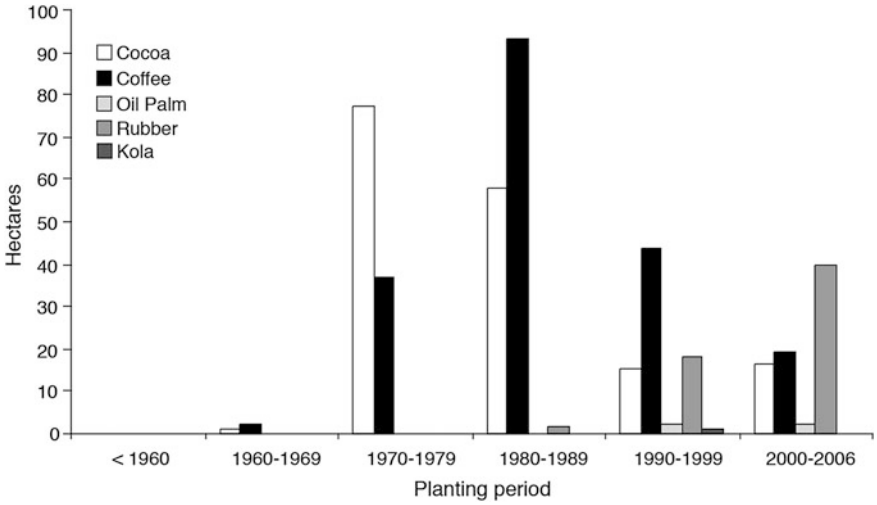

Fig. 2.13 Age structure of perennial crops in the Moyen-Cavally region, Côte d'Ivoire, in 2005–2006

Table 2.6 Crops preceding perennial crops in Cavally

Crop	Preceding crop (ha)				
	Forest	Fallow	Old coffee plants	Old cocoa trees	Total
Coffee	103.5 (58 %)	16.0	6.0	52.1	177.6
Cocoa	136.0 (75 %)	8.0	17.0	20.0	181.0
Rubber	12.5 (23 %)	37.0	2.0	4.0	55.5
Total	252.0	61.0	25.0	76.1	414.1

crops but observed a high rate of cocoa mortality. They then retreated to coffee, to the point that they even replanted coffee in the understory of the dying cocoa trees (Table 2.6). Then, a fall in coffee prices and the continued mortality of cocoa encouraged diversification into rubber cultivation, introduced in the 1980s on rubber estates. However, at least until 2006, coffee remained in second place because it was the only suitable crop to grow during the financially unremunerative period of the rubber cultivation cycle. In January-February, the farmer cannot harvest and sell rubber while coffee can be sold at this time of the year (Fig. 2.13).

2.3 National Aggregates from 2006 to 2011

In 2006, the average farm—assuming such a theoretical entity really exists—at the national scale farmed 6.5 ha of which 3.7 ha were devoted to cocoa cultivation. It still retained 1.0 ha of coffee and had diversified into 1.0 ha of oil palm trees, 0.5 ha

Table 2.7 Cultivated areas of perennial crops for an average farm, based on the 2006 evaluation

Perennial crop	Change in areas (ha) devoted to perennial crops for an average farm						
	<1960	1960–1969	1970–1979	1980–1989	1990–1999	2000–2006	Total
Cocoa	0.1	0.2	0.8	1.0	0.8	0.8	3.7
Coffee		0.1	0.2	0.3	0.3	0.1	1.0
Oil palm				0.2	0.5	0.3	1.0
Rubber				0.1	0.1	0.3	0.5
Others				0.1	0.1	0.1	0.3
Total	0.1	0.3	1.0	1.7	1.8	1.6	6.5

Sources CIRAD and A&V-Vie surveys 2006

of rubber and 0.3 ha of other perennial crops (coconut, cashew, kola tree, teak and citrus) (Table 2.7 and Fig. 2.14).

As we have seen throughout this chapter, these averages are not simple additions of surface areas from one period to the next, but the resultant between the new plantations established on forest or fallow and crop substitution on the plot, to which are added some replantings.

As far as the famous 'coffee-and-cocoa combination' as the historical foundation of the plantation economy of the Ivorian forest area is concerned, it still represented 72 % of the area devoted to perennial crops in 2006. This combination left only 28 % to all the diversification crops consisting of oil palm, rubber and others such as cashew, coconut and teak (Table 2.8). Over the 2000–2006 period, the process of diversification reached 44 %; but the initial, paradoxical, observation remains that of the relative durability of cocoa, at least at a statistical level.

At the beginning of this chapter, we quoted P. La Vaissière—then an economist at the Coffee and Cocoa Institute—on the complementarity of these plantations with respect to the land factor. A statistical analysis of the national agricultural census of 1975 proves him right. In the 1970s, the development of cocoa cultivation in the country was mainly the result of significant migrations. It took off without compromising coffee production which tended to be the domain of autochthons. Similarly, the government's oil palm plan at the end of 1960s was put in place in a context when land and forests were still largely available. At least from the 1980s, a dual process operated at the plot scale and that of the farm. On the one hand, there

Table 2.8 Distribution of perennial crop areas in Côte d'Ivoire

Perennial crop	Area existing in 2006		Area planted during 2000–2006	
Cocoa (%)	57	72	50	56
Coffee (%)	15		6	
Oil palm (%)	15	28	19	44
Rubber (%)	8		19	
Other (%)	5		6	

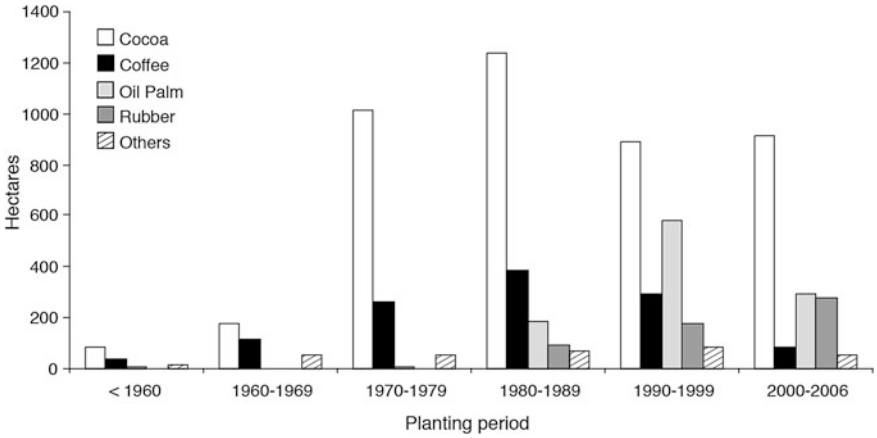

Fig. 2.14 Age structure of perennial crops in Côte d'Ivoire in 2005–2006

was an acceleration of forest clearings almost exclusively for growing cocoa while, on the other, old coffee plants and cocoa trees were felled to be replaced by different perennial crops, mainly oil palm and rubber. Cocoa trees also began to replace old coffee plants, mainly due to disposal and sale of old coffee plantations by autochthons to migrants (see Table 1.1 in the Chap. 1).

An analysis of the preceding crops of plantations demonstrates this dual process. It explains the ability of Côte d'Ivoire to maintain its position as the world's largest cocoa producer, while still proceeding with diversification (Fig. 2.14).

Ultimately, these detailed snapshots of Côte d'Ivoire's cultivated areas, region by region, and national aggregates for the 2005–2006 period have proven invaluable for understanding the dynamics of Côte d'Ivoire's plantation economy in 2012. Contrary to many experts' estimates, cocoa production in Côte d'Ivoire has not fallen. Instead, it even reached new peaks in 2010–2011, with around 1.5 million tonnes. In addition to favourable cyclical climatic factors, there was a significant revival in investment in cocoa cultivation leading up to 2005–2006. This is the main reason that cocoa production in Côte d'Ivoire has been maintained and even increased. According to a universal historical process, these new investments have continued to counteract the phenomena of aging and to increase production.

As for the future, even disregarding potential investments beyond 2006 and given the economically useful life of 25 years of cocoa trees, these analyses of 2005–2006 suggest that the cocoa production should theoretically hold up well for a few years. However, the history of cocoa cycles reminds us of the impact of ecological changes (decreased soil fertility, disease pressure, cocoa mortality). In Côte d'Ivoire, since the late 2000s, this process has been accompanied by an intrusion of rubber cultivation into agricultural landscapes, especially along roads.

2.3.1 Boom in Rubber Cultivation at the Turn of the 2000 Decade

Without going into region-by-region details, the trend confirms an accelerated decline in investments in coffee cultivation, the maintenance of the dynamics of cocoa plantations, especially in certain regions such as Cavally, and exponential growth of rubber plantations from 2006 to 2009 (Fig. 2.15).

Ad hoc surveys conducted in 2010 and 2011 in several small regions highlighted a sharper slowdown in investments in cocoa cultivation, mainly to the benefit of rubber (Figs. 2.16 and 2.17). Figure 2.18 illustrates the particular case of a village where a development project promoted cocoa replanting based on the distribution of hybrid planting material ('18 months cocoa'). It included a demonstration plot and farmer training. The project indeed revived cocoa investment leading to a new peak for cocoa plantations in 2010, especially in Campement Bernard village where plantations were undergoing conversion to rubber. But 2 years later, a very high mortality rate for cocoa was observed. In fact, very few of the plantations set up in 2009 will even reach the production stage. The difficulties experienced in replanting cocoa on degraded soils reinforced the farmers' desire to switch to cultivating rubber.

In 2012, a simple reading of the landscape confirmed these results. In Bas-Sassandra, it was difficult to observe any cocoa along the Soubré-San Pedro axis or even sometimes along tracks perpendicular to it, for example, the track starting from Gabiadji up to 20 km north of San Pedro. And as for rubber plantations, they were largely dominated by young and still-immature plantations. In

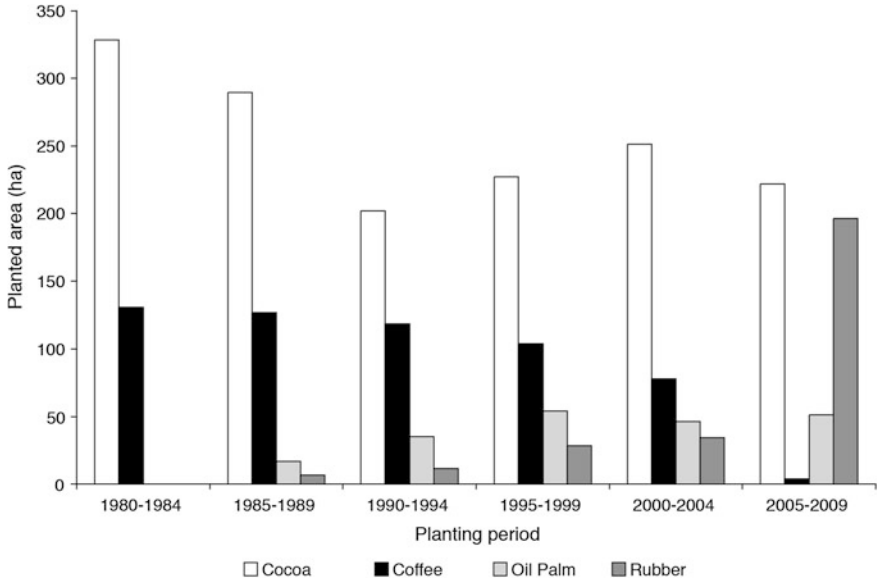

Fig. 2.15 Structure of areas under cultivation for cocoa, coffee, oil palm and rubber in Côte d'Ivoire in 2008–2009 (431 farms). (*Source* Ruf and Akpo 2008; partially updated in 2009–2010)

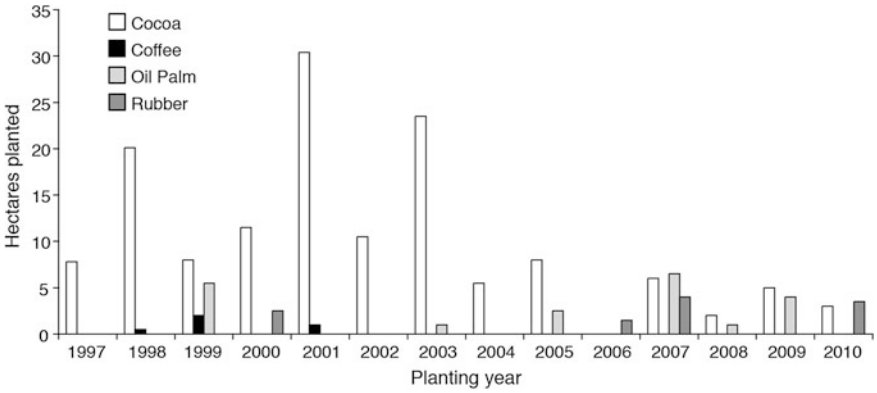

Fig. 2.16 Planting years as reported by farmers in 2011 in the east and centre-west of Côte d'Ivoire in 2011 and from 1997 to 2010. (Data collected from 5 villages and 94 farms in Moyen-Comoé and Haut-Sassandra regions. *Sources* Author's survey, 2011)

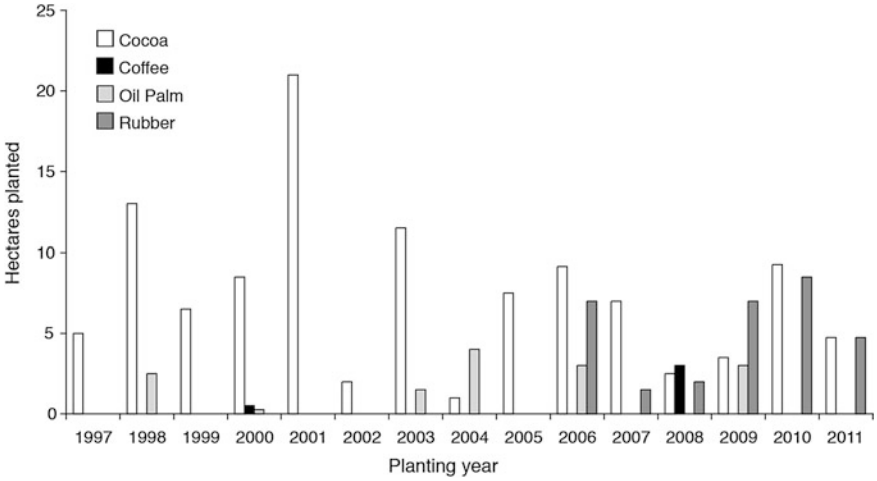

Fig. 2.17 Planting years as reported by farmers in 2011 in the centre-south of Côte d'Ivoire from 1997 to 2011. (Data collected from 4 villages and 70 farms in Tiassalé *département*. *Sources* Author's survey, 2011)

2012, we estimated that two-thirds of rubber areas were immature. This suggests a tripling of production before 2020. While the production of dry rubber was of the order of 235,000 tonnes in 2011, it could well reach or exceed 600,000 tonnes by 2020.

But like in every previous historical period when the world started worrying about its cocoa supplies, cocoa has to be procured from where it is available: far from paved roads and deeper into the bush where the production of adult cocoa

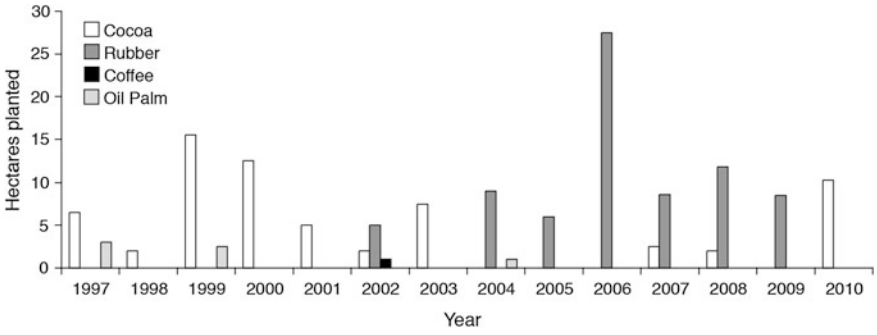

Fig. 2.18 Planting years as reported by farmers in 2011 in the village of Campement Bernard from 1997 to 2010, in south-western Côte d'Ivoire. (Data obtained from 41 farms in the village of Campement Bernard, San Pedro *département.*) In 2010, investments in cocoa cultivation were made through a project. But in 2012, a cocoa mortality rate of more than 60 % was observed. (*Sources* Author's survey, 2011)

trees can still yield around 700 kg/ha with some insecticide use. But these cocoa plantations are mainly found on remote agricultural frontiers, on land obtained by clearing the country's protected forests, far from the existing cocoa belt in Soubré.

2.3.2 Survival of the Cocoa Sector Through Clearing of Protected Forests

Because of the political and military crisis, we could not linger in the Cavally and Montagnes regions or in the outlying areas of Haut-Sassandra. But brief forays allowed us to observe a very strong cocoa cultivation dynamic through the resumption of clearing of protected forests, especially from 2008 onwards. Thus, in the protected forest of Goin Débé—which the farmers have humorously nicknamed 'If you want', in the sense of 'if you want, if you are strong, take the risk, buy and clear the land'—open interviews with the autochthons and migrants allowed us to understand the process underway.

To address the issues of diversification, it is important to understand the cycles of cocoa, how this crop can be maintained for a long period in the same country by progressive relocation from one region to another.

In the 1970s and 1980s, having supported the idea of forest protection to protect the environment of the autochthons, the administration of President Houphouët-Boigny allowed Baoulé migrants to enter the forest reserve, over the autochthons' protests. In the 2000s, the frustration of these latter only grew on finding out that the Gbagbo regime did not respond to their complaints to evict the Baoulé or declassify the rest of the forest. This frustration and the low income of autochthons drove them to sell what remained of the forest, mainly to the Burkinabé migrants.

In the same period, the conflicts triggered between the autochthons and the Burkinabé in neighbouring areas created a local demand. Paradoxically, when evicted from a forest where they had started planting cocoa, many Burkinabé migrants were not discouraged and began to look for another forest. These movements promoted contacts between refugees, including in Burkina Faso. They disseminated information about the new availability of forest areas in Goin Débé.

Another amazing paradox is that a forced return to Burkina Faso facilitated contacts between repatriated migrants and labour reserves in the original villages. Once a forest was acquired, it became easier to organize the influx of labour from Burkina Faso by the busloads. The politico-military crisis and the control of the entire northern area by rebel forces facilitated this bus traffic from the north. During the same period, cocoa mortality and falling incomes in Bas-Sassandra triggered internal migrations from the south to Cavally. In this case, migrants who had been settled for a long time had some financial resources. Population pressure, in combination with the cocoa cycle, also played a fundamental role: the sons of immigrants, especially from Bas-Sassandra, wanted to try their luck.

In the old areas under the control of rebel forces or in new areas—which theoretically come under the savannah zone—but where protected gallery forests were still found, clearing by migrants also generated thousands of tonnes of cocoa in the early 2000s.

Finally, international NGOs indirectly provided reassurance to migrants by wanting to settle the conflict; this merely had the effect of attracting new migrants to the area. Thus, several thousands of young migrants converted thousands of hectares of protected forest into cocoa plantations in the late 2000s. At the same time, their parents or brothers in the cocoa-growing areas of Bas-Sassandra and Cavally diversified out to rubber. This process is typical of the history of cocoa cultivation; it combines specific situational factors with structural factors of a cocoa cycle's functioning.

The prospective outlines developed earlier are therefore buttressed. Except in case of an outbreak of a rapidly spreading disease or pest pressure, cocoa production in Côte d'Ivoire is expected to decline only slowly over the next several years, while the production of rubber, now the new solution to youth unemployment, is expected to triple between 2010 and 2020.

2.4 Interpreting Replanting and Diversification Processes

2.4.1 Not Much Replanting, but a Form of Sustainability of the Cocoa Sector

The perception of aging of cocoa trees, even though partially contradicted by the data, persists in the scientific literature. Based on two studies conducted in 1993–1994 and 2001, the researchers concluded as follows:

- ‘Even though the average age of harvested trees has not changed much between 1994 and 2001 (it still ranges between 20 and 30 years)—which seems to imply that there is no marked aging (yet?) of the Ivorian cocoa trees,—the share of older orchards, those over 30 years of age, which are seeing a net increase, is a factor to watch. Indeed, once a cocoa tree exceeds 35 years of age, a marked decline in its productivity is observed’;
- ‘The aging of plantations is nevertheless inexorable. In fact, in 10 years there will be more trees older than 40 years than there will be trees younger than 5 years if the rate of new plantations remains at current levels. Consequently, the national average yield could decrease to about 250 kg/ha. With land reserves decreasing, it is imperative to promote the intensification of technical itineraries on existing cocoa trees and the replanting (or rehabilitation) of old orchards’ (Aguilar et al. 2003).

The initial results of surveys presented here shows that the cocoa orchard has not aged as rapidly as expected. The revival of investments in cocoa family farming in the 2000–2006 years has once again pushed back the inexorable deadline of aging. On the other hand, new cocoa plantations were still being set up in the late 2000s at the expense of forests—mainly protected ones—alongside the borders of Côte d’Ivoire with Guinea and Ghana, as well as internal border between the Gbagbo regime and the New Forces.

In 2006, the pace of cocoa investments was maintained primarily through the clearing of forests. But we did see some progress in the process of replanting cocoa in Côte d’Ivoire (Table 2.9).

During the 2000s, these innovations originated primarily from the farmers themselves, without any help from research or the use of selected planting material. They were very dependent on labour. Those growers who succeeded in replanting were generally those who planted on small areas, mainly autochthon youth returning from the city because of the lack of employment there, before they moved on to cultivating rubber. They were also those who still had a sufficient labour force to start replanting several times, forced to do so because of recurrent mortality. Most often, these farmers were migrants from the north, mainly Burkinabé.

Also observed was a cocoa dynamic in the forest-savannah contact zone and in the east. This dynamic resulted from a combination of several phenomena, at the intersection of ecological and social change:

- the recovery of secondary forests. Consistent with the great migrations of the 1970s and 1980s and after the plantation fires of 1983, 20 years of respite for this type of emigration region gave a chance for secondary forests to recover. They represented a new potential for cocoa, a new agricultural frontier and new forms of expansion of cocoa at the expense of a reconstituted forest;
- the progressive learning of how to replant cocoa on fallow and old coffee and cocoa plantations;
- the land saturation in Haut- and Bas-Sassandra. Migrants who left for the west reached the ‘end of their forest’; there was nothing left to be cleared; the aging

Table 2.9 Distribution of plantations according to their preceding crop

Type of plantation	Fromager region, soils favourable to the cocoa tree (%)—136 plots	All regions (%)—1869 plots
Plantation created after clearing forest (mainly cocoa)	40	59
Plantation created after clearing fallow without trees, type *Chromolaena odorata* (mainly oil palm and rubber, some cocoa)	31	9
Replanting of the same perennial crop (mainly oil palm followed by oil palm)	18	13
Replanting but changing the perennial crop (mainly diversification from coffee to cocoa, then oil palm to rubber)	12	19
Introduction of a new perennial crop interplanted with an existing crop	<1	<1

Sources Author's survey on behalf of the EU, 2006

and mortality of cocoa was impoverishing them. These migrants were attracted by the forests which had partly recovered in their villages of origin;

- the Ivorian crisis, uncertainty and land-tenure security. Migrants reverted to being autochthons with increased land-tenure security and contributed to the restart of a cocoa cycle. The events of 2002–2011 have increased the role of this 'risk' component;
- rubber as an alternative and with competition still limited in the 2000s. It is mainly cultivated at the expense of coffee.

2.4.2 The Decline of the Coffee Sector

The decline in investments in coffee cultivation was sharper and occurred earlier: abandonment of plantations and felling and substitution by oil palm, cocoa, rubber, cashew, or even kola.

Where the soils were not—or no longer—suitable for cocoa and where rubber had not yet arrived, farmers were forced to keep growing a little coffee, even if they had temporarily abandoned its cultivation. When the price rose, as happened in 2005–2006, they made an effort to harvest a little more. We have also observed cases where the coffee plant is used to provide shade temporarily for replanting cocoa, as in the Abengourou *département*. But on the whole, the country's coffee plantations are gradually becoming placeholders for rubber. As for coffee cultivation, the primary determinant of its decline is the price-income ratio. It is much too low given the high labour requirements, mainly during harvest time.

2.4.3 Rubber: An 'Employee Farmer' and Easy Replanting on Degraded Soils

'Growing rubber is just like being a government employee.' One of the primary benefits of cultivating rubber is the quasi-monthly regularity of income.

The difficulties of replanting cocoa after deforestation vary from region to region. It is particularly difficult in Moyen-Cavally and Bas-Sassandra whose soils agronomists have already found to be unsuitable for the cocoa tree. For these soils at the boundaries of the cocoa ecotype, deforestation and loss of forest rents are particularly difficult to overcome. Growers in these regions cite these difficulties more than 50 % of the time against only 25 % in the overall forest area (Table 2.10).

Replanting decisions are also influenced by the alternatives available. If we can draw a parallel with the popular saying, 'Give a dog a bad name and hang him', the attractiveness of the rubber sector can lead farmers to exaggerate the effects of cocoa mortality in a very relevant and precise manner:

- 'the land is not suitable for growing cocoa; it requires frequent pesticide treatment to obtain a good production. I have to treat my cocoa plantation six times a year';
- 'the land in this area (Cavally) is not conducive to cocoa cultivation. Because once it dies, it is difficult to replant';

Table 2.10 Reasons advanced in 2006 by growers (in % for each region) to explain their decision to diversify towards perennial crops

Reasons advanced for choosing to diversify	Zanzan, seriously affected by the 1983 fires (%) (total: 43 plots)	Bas-Sassandra and Cavally (%) (total: 43 plots)	All regions (total: 373 plots)
Price-income factors (mainly for coffee): Price is too low, crop no longer has value or attractive price of the new crop	4	42	51
The labour force no longer wants to work on this crop (mainly coffee, some cocoa)	0	0	10
Mortality of the initial crop, unsuitability of the soil for this crop (mainly cocoa)	84	53	27
Other reasons (decision to diversify, imitation effect, advice, experiment)	12	5	12

Sources Author's survey, 2006

- 'it is cocoa's mortality and the advent of rubber in the area that has led to the clearing of protected forests' (according to growers in San Pedro and Cavally 2011).

One interpretation of these statements is that the arrival of the rubber has ended up by discouraging farmers from replanting cocoa. Outside protected forests, many farmers have benefited from the rubber cultivation projects of private companies. Assistance provided to them in the form of training and planting material was decisive in the early adopters' decision to diversify into rubber cultivation. At the same time and irrespective of any opportunities, the reasons cited by farmers and the way they express themselves are clear: deforestation and soil degradation clearly remain the primary structural factors for diversification into rubber.

A reference book on the agronomy of rubber, published 60 years earlier by Dijkman in Indonesia, is in good resonance with farmer observations in Côte d'Ivoire: 'The good adaptability of *H[evea] brasiliensis* grown in Indonesia has saved many plantations that were financially weak, due to soil conditions which were unfavourable for the production of other competing crops (coffee, cocoa and tobacco). We found, for example, that at the same altitude above sea level in Java, coffee is planted on the best soils and the rubber on the worst. In Sumatra, tobacco plantations in Deli are on the best soils and, again, rubber plantations are on the worst. Because of its adaptability, rubber was more or less considered a weed with relatively low soil requirements. However, it would be wrong to assume that rubber cannot be grown on better soils. Indeed, these examples only indicate that rubber is a crop better adapted to poor soils as compared to coffee, tobacco or rice' (Djkman 1951, 17).

In addition to this structural ecological determinant, the increase in producer prices in recent years have played a role in every sense of the term: the economic success of the first rubber farmers have created ripples, partly at the expense of oil palm.

2.4.4 Difficulties of the Oil Palm Sector

After the success of the two major oil palm plans, liberalization led to an interesting plantation dynamic with a third wave of investments in the sector during the 1990s (Cheyns et al. 2001; Cheyns and Rafflegeau 2005; Naï Naï et al. 2000; Chap. 4 of this volume). The difficulties experienced by the sector were largely confirmed at the national scale by the 2006 survey, mainly because of falling prices. This observation was evidenced by the gradual disappearance of many services formerly provided by Palmindustrie: most notably, transport was less well provided for by the companies that bought up the processing plants. Oil palm cultivation seemed to be in trouble in some regions, encountering stiff competition from rubber whose profitability was clearly visible in the economic success of farmers cultivating it.

However in some cases, as in Sud-Bandama, the challenge of oil palm cultivation was taken on by the 'oil and soap' artisanal sector. The growth in national and regional demand helped offset the decline in exports.

2.4.5 The Dynamics of the Cashew Sector

After the fires of 1983, when the forest could not recover in several areas where forests meet savannah, it became difficult to replant cocoa (and even coffee). The dynamics of cashew then held sway. The cashew tree is known for its resistance to fire. It is often planted without help of support structures, and does not require special planting material. (In any case, there is no specially selected planting material available.) These cashew dynamics constitute another example of ecological change as the primary structural driver of diversification.

2.5 Boserupian Diversifications

Can we interpret the diversification of coffee- and cocoa-cultivating regions towards oil palm, rubber and pineapple as a type of Boserupian innovation? The introductory chapter discussed the Boserup versus Malthus debate and its application to plantation economies. The history of cocoa cultivation, especially in Côte d'Ivoire, teaches us that the most common solution consisted of abandoning the cocoa plantation and establishing another through migration to a new agricultural frontier area, where the process of forest clearing could once again be taken up (Léna 1979; Ruf 1988, 1995; Schwartz 1979, 1993; Chauveau and Léonard 1996). This is, at least in part, the neo-Malthusian process.

If peasant societies—undergoing high population growth as a result of massive migrations—are faced with the deterioration of their environment, their production and their income and thus try innovations on site, a Boserupian process results. Applying the rigorousness of the Boserupian approach of the 1960–1970 period, these innovations involve an increase in labour time, consistent with population growth. In a modernized interpretation of Boserupian theories, this increase in labour is not indispensable; innovation can involve instead an increase in inputs and capital.

The theory of diversification, seen as Boserupian innovation, can a priori be called into question if diversification results in an extensification, in the sense of falling incomes and labour per unit surface area. For example, oil palm cropping systems sometimes have a reputation for not being labour intensive. Furthermore, if there is a change of actors, for example with a growing presence of UMCIs in rubber cultivation and evictions of farmers, the diversification process will be different; it will have a dominating political dimension.

To address these issues, we first examine three attempts—over a period spanning from the 1960s to the late 2000s—to assess labour time and plantation budgets in

Table 2.11 Comparative income per crop, per hectare and per day of labour in 1981

Period	Criteria	Oil palm		Traditional coffee	Traditional cocoa	Rubber
	Yield (kg/ha)	6,000	11,500	350	300	1,500
	Number of days of labour	42	52	70	35	81
1966–1970	Price FCFA/kg	4	4	90	70	–
	Gross income (FCFA/ha)	24,000	46,000	31,500	21,000	–
	Income per day (FCFA/day)	571	885	450	600	–
1976–1980	Price FCFA/kg	10	10	250	250	130
	Gross income (FCFA/ha)	60,000	115,000	87,00	75,000	195,000
	Net income (FCFA/ha)	53,000	88,850	81,000	74,000	186,805
	Income per day of labour (FCFA/day)	1,262	1,709	1,157	2,114	2,306

Sources based on Colin 1990a, b; Hermann 1981; compiled from various sources

Côte d'Ivoire (Tables 2.11, 2.12 and 2.13). These are budgets of plantations which are in the production phase. In all the cases, the decision to fell an old cocoa tree and replant another cocoa tree or replace it with another perennial crop requires an investment of labour and capital—which is already in itself a Boserupian process.

As regards the production phase, the three estimates highlight the process of the increase of labour required when transitioning from cocoa to rubber, or to oil palm

Table 2.12 Gross and net income per hectare and per crop, at Djimini-Koffikro, in 1983–1984

Crops	Yield kg/ha	Price/kg	Per-hectare income		Income per labour day	
			Gross income (FCFA/ha)	Net income (FCFA/ha)[a]	Number of days of labour	Net income/days of labour (FCFA/day)
Oil palm Djimini	9,600	15	144,000	128,000	51	2,509
Coffee Djimini	49	350	17,000	17,000	17	1,000
Cocoa Djimini	63	350	22,000	22,000	13	1,700
Rubber	1,750	240	420,000	343,000	69	4,971
Pineapple (tinned) Djimini	60,000[b]	60,000[b]	780,000[b]	280,000[b]	418[b]	670[b]
Pineapple (export) Djimini	47,000	47,000	1,175,000	750,000	332	2,259

Source Colin 1990a, b

Revenue is presented on an annual basis for perennial crops and on the basis of the duration of the cycle for pineapple (19 months)

[a]Without taking labour costs into account

[b]for a crop grown normally, with proper maintenance and without diversion of inputs

Table 2.13 Estimation of production, labour and labour productivity during the course of the life cycle of a cocoa plantation, replanted with rubber in the 1930–1935 period and from 2008 to 2010

Criteria	Adult cocoa	Aging cocoa	Cocoa affected by mortality	Adult rubber
Age of the plantation (years)	15	25	30–35	40–45
Production of cocoa or rubber (kg/ha)	700	300	150	1,500
Number of labour days	80	45	35	72
Economic conditions in 2008				
Price of cocoa or dry rubber (FCFA/kg)	450	450	450	650
Value realized from one labour day	3,188	2,556	1,643	13,889
Economic conditions in 2009				
Price of cocoa or dry rubber (FCFA/kg)	900	900	900	450
Value realized from one labour day	7,125	5,556	3,571	9,444
Economic conditions in 2010				
Price of cocoa or dry rubber (FCFA/kg)	800	800	800	1,050
Value realized from one labour day	6,250	4,889	3,143	21,319
Economic conditions in 2010 (before tax)				
Price of cocoa or dry rubber (FCFA/kg)	1,150	1,150	1,150	1,040
Value realized from one labour day	9,313	7,222	4,643	21,111

Source Ruf 2012

With the assumption of dry rubber yield of 1500 kg/ha equivalent to 2500 kg of fresh or wet rubber, as cup lump

and, *a fortiori,* to a plot of pineapple. There is sometimes a decrease of gross and net production per hectare when switching to oil palm. But here too, this decline is observed only during a comparison with a traditional plantation in good condition (Table 2.11) or one which is very well maintained (Table 2.12). This is even more so when comparison is made not to a 'traditional' cocoa plantation meeting agreed standards but to an aging cocoa plantation affected by mortality and falling production, in other words, to a cocoa plantation as it appears when the farmer must make the decision to replant or diversify (Table 2.13).

However, the diversification from coffee—which is very labour-intensive—to other crops, including to cocoa, is much less a Boserupian process. It is a matter basically of a market and price mechanism in an environment of low technology use, especially due to the closure of centres producing coffee planting material. It is also a matter of mediocre productivity per hectare and per labour day in Côte d'Ivoire.

This reference to technology and productivity is not limited to coffee; it applies to rubber too. In 2010, the increase in world rubber prices and the subsequent high prices paid to farmers led to labour productivity for clonal rubber that was 3 times higher than for a well-maintained adult cocoa plantation, and 7 times that of an

aging cocoa plantation. Even when the effect of taxation was removed, which strongly penalized cocoa farmers, the ratio still ranged between 2 and 5.

These ratios increased further in 2011 thanks to still-higher prices. Of course, these high prices were not sustainable and, of course, at the beginning, rubber cultivation in villages obtained high yields because of very close technical assistance from private rubber companies. But over the medium term, we can probably make the assumption of a shortening of the economic life of a rubber plantation and a possible decline in average yields over the years, especially due to over-tapping, the falling over of rubber trees sensitive to high winds and the inevitable decline in the level of supervision given the growing demand for the crop.

Nevertheless, in 2010–2011, we observed instead an opposite trend with yields often reaching between 3000 and 3500 kg/ha in cup lumps or around 2500 kg/ha for dry rubber (Chaps. 7 and 8). These observations on the current absolute supremacy of the productivity of rubber in Côte d'Ivoire lead us to the notion of rent.

2.6 Diversification Towards Rubber, an Expression of New 'Rents'

Without formalizing them, and despite the collapse of the world price of 2013, we propose some avenues for reflection in this section on the nature of the 'rubber rents' and on their evolution.

2.6.1 New Crop Rent

As a new crop, rubber has not yet attracted major diseases and pests. Just like the cycles of cocoa, we can assume that over the years, insects, fungi or viruses will eventually adapt to this new crop and increase the risks and costs of cultivating it.

2.6.2 Project Rent and Scale

As a new crop, rubber cultivation in villages initially benefitted from financing and a very high quality of supervision and advisory support. Today, the plantations which have been established are losing in quality and therefore in future productivity as a price to pay for massive expansion of the crop.

2.6.3 Cocoa-Taxation Rent

It is said that the heavy taxation on cocoa penalizes it and thus benefits rubber. But, as we have seen, even if the cocoa tax is removed, rubber retains a net advantage in

income. Nevertheless, this historical tax on cocoa is helping attract farmers to rubber. A gradual revision of this tax could reduce some of this 'politico-historical rent'. But the fact that influential UMCIs and senior government bureaucrats have invested heavily in rubber will not favour a rebalancing anytime soon.

2.6.4 Rent of the Suitability of the Crop to Transformed Soils

Basically, we have seen that rubber grows and is productive in degraded and acidified soils. It is as if cocoa consumes the forest rent and prepares the ground for rubber, at least in areas with soils that are unsuitable for cocoa. Of course, the cocoa farmers reacted and began to apply fertilizer when their incomes allowed them to, but a 'competing' tree that can produce without fertilizer is in itself a form of rent. And in all the regions studied, we saw that more than prices and projects, it is the problem of soil degradation and of replanting cocoa that is the main driver of diversification, especially towards rubber. This component of the rubber rent, a form of physiological rent, will be very difficult to overcome by the proponents of the cocoa sector, especially in the current cocoa-growing belt. Once deforested, the diagnosis of this region's potential becomes identical to that advanced by agronomists in 1970: the region's soils are not suitable for cocoa cultivation.

2.6.5 Rent of Technology and Technological Progress

To a large extent, the spectacular productivity of rubber is due to technological progress, especially to the creation of high-yield clones. In Asia, the continent of choice for rubber cultivation during the 20th century, the introduction of clones led to an overall increase in yields and labour productivity by factors of 3–4 (Chap. 7). Countries like Côte d'Ivoire have directly benefited from these Asian experiences. Of course, there is also a physiological component. Unlike cocoa, oil palm or coffee, the rubber product is not a fruit. With the current state of technology, when one doubles the yield per hectare of cocoa or coffee, one certainly improves the productivity of the labour day—but we cannot double it. Indeed, a part of the harvest and post-harvest work remains proportional to the number of cocoa pods or coffee beans. But, on the other hand, for rubber, whether we fill a latex cup only to one-third or to the brim does not change the work of the incision on the rubber tree. Moreover, whereas for cocoa cultivation, clonal work is in its infancy, we can consider that the rubber tree-capital has a technological lead, thus generating a form of rent. But for how long? It is evident that without mechanization of the harvest, it is probably not easy to reproduce the impact of technical progress seen on rubber cultivation in terms of labour productivity on trees exploited for their fruit.

The technological advances in the rubber sector and, to some extent, in the oil palm sector illustrate a Schumpeterian view of the economy. The evolution of the Ivorian plantation's economy towards diversification is partly the result of successful innovation in the rubber and oil palm sectors. We can also mention a 'capitalization rent' in the Ricardian sense of the term. We will return to this notion in Chap. 7.

2.6.6 *Labour Rent*

In Côte d'Ivoire, the gap between the economic performance of rubber plantations and that of cocoa plantations is also explained by the inertia of labour costs generated by lower income from cocoa. In fact, cocoa is still—by far—the dominant crop and thus always plays a role in determining labour costs. Farmers who cultivate rubber benefit directly from this inertia.

In an agricultural economy still dominated by cocoa cultivation, a cocoa plantation owner offering up his plantation for sharecropping still retains two-thirds of the gross income. Taking into account his portion of the cost of inputs and excluding depreciation of the investment in the plantation, his share can be estimated at 55–60 % against 40–45 % for the sharecropper.

In southern Thailand, where the agricultural economy is dominated by rubber cultivation, the ratio is similar: the tapper sharecropper receives between 40 and 50 % of the production.

In Côte d'Ivoire, the proprietor of a rubber plantation made an average of 400 FCFA/kg of wet rubber in 2008, 270 FCFA in 2009, 555 FCFA in 2010 and 800 FCFA in 2011 under the same conditions and without taking depreciation into account. Until 2010, he paid his tapper between 35 and 50 FCFA/kg. During the same period, the cost of production hovered around 70 FCFA/kg taking into account the costs of maintenance, weeding and inputs. A glance at the comparison drawn with Thailand—covered in greater detail in Chap. 7—shows that the ratios of rubber prices paid to farmers and labour costs are revealing (Table 2.14).

After the continued increase in the price of rubber in 2011—it reached 800 FCFA/kg of wet rubber—some tappers earned 100 FCFA/kg, taking the production cost to around 150 FCFA/kg. Even then, the P/C ratio remained greater than 6.

Table 2.14 Ratio of prices and labour cost for rubber cultivation in 2010

	Côte d'Ivoire (FCFA)	South-Thailand (Baht)
Price paid to rubber producers (P)	550	100
Labour cost per kg (C)	70	50
P/C ratio	7.8	2

Without its partial indexation to the price of cocoa, the cost of labour would better follow the progression of rubber prices. Villages where rubber has become the dominant crop have seen an increase in labour costs (to around 100 FCFA/kg). But this increase is still modest. This is one explanation of the origins of rubber rent in Côte d'Ivoire. The regularity of income, which allows the rubber grower to think of himself as a government employee, reinforces this notion of rent.

In the end, even though the notion of 'rubber rent' remains to be explored in depth at the theoretical level, it is already well established as the driver of growth of rubber cultivation. It therefore seems very hard to reject the principle of a rent in explaining the very high incomes of Ivorian rubber grower. The role of 'rubber rent' is more understandable when considered as a factor for attracting UMCIs and retirees to agriculture in recent years. They invest little or nothing in cocoa plantations but do so heavily for rubber. Not surprisingly, more and more farmers are following the same path.

2.7 Dynamics of the Actors Involved by Type of Farm

2.7.1 Rubber Estates

Cultivation of *Hevea brasiliensis* was introduced to Côte d'Ivoire in the form of rubber estates during the 1950–1960 period. For several years, the villagers remained indifferent, convinced that rubber was a preserve of the 'rich'. Moreover, some villagers still remembered that their parents had been subjected to forced labour to collect wild rubber and thus chose to keep away from this crop. And, finally, for several years, rubber estate owners preferred to retain a monopoly over rubber cultivation and the traceability of their rubber, especially to reduce the risk of theft of production. Over the years, the situation changed and these estate owners understood that it was in their interest to encourage not only farmers but their own senior and mid-rank staff and others from the liberal professionals to engage in rubber cultivation.

This presence of the rubber agro-industry in Côte d'Ivoire in the form of a few estates ultimately proved to be an advantage for building a network of monitors. It also helped in the provision of advice, technical support and other services, most notably the supply of high-yield planting material to farmers. The presence of rubber estates is an advantage over the cocoa agro-industry, which has factories at the ports but no estates.

2.7.2 Private Plantations: UMCIs and Villagers

In 2012, there were no statistics to differentiate the production by UMCIs from that by villagers. The statistics provided by Apromac—the Association of Natural Rubber Professionals in Côte d'Ivoire—differentiate only between factory plantations and private plantations. The latter accounted for 42 % of national supply in 2003, a share that increased to 62 % in 2007. From the time of the 2002 politico-military crisis and especially from 2005 onwards, high-ranking civilians and military officers close to the Gbagbo regime invested heavily in rubber (Ruf 2011a). But most of these plantations began production only from 2010–2011. In the late 2000s, 'private' entities producing rubber were still mostly villagers. But who were these villagers?

2.7.3 Autochthons and Migrants

Initially, the rubber agro-industry favoured the autochthons for several reasons. On the one hand, in cases where agro-industrial estates were set up on land on which villagers claimed rights, it was in the interests of the plantations' owners to resolve conflicts by helping villagers plant rubber trees. On the other hand, when agricultural projects which were funded by international donors came up, one of their stated objectives was to reduce the risk of abandonment of rubber plantations due to land disputes. Rightly or wrongly, the autochthons were considered more reliable on this point, as compared to migrants who negotiated access to land with their autochthonous '*tuteurs*'.[2] And, more practically, autochthonous villages are often located closer to roads than are migrant camps. This facilitates contact with their residents and the future cultivation of and trade in rubber. Finally, autochthons grow their food crops in rotation with fallow and thus have recent fallow plots available which are particularly favourable for rubber cultivation.

For their part, the autochthons attempted to become part of village rubber cultivation projects. By claiming to be the holders of land rights and having already sold a lot of land to migrant cocoa farmers, these autochthons saw an opportunity to get back at the latter by adopting rubber cultivation. They tried to slow the adoption of rubber cultivation by migrants; partly to keep or recover the land, to extract a kind of 'land or *tutorat*' rent. According to Colin (2008), the conversion to rubber

[2]Traditionally, for an outsider to the community, land access was part of a broader process of integration into the community, by way of a *'tutorat'* relationship (Chauveau 2006). Through this patronage relationship, an autochthon (the *tuteur*) granted to a migrant rights to land (on uncleared forest taken from the village or lineage land reserve), according to a principle of moral economy, namely, all individuals should get access to the resources necessary for their subsistence. The migrant (or his heirs), in turn, had a 'duty of gratitude' towards his *tuteur* (or the latter's heirs), expressed through everyday civilities and through the offering of gifts after harvests and on important social occasions, such as funerals (Chauveau 2006; Colin 2008).

cultivation is indeed a source of contestation of migrants' land rights, in particular by the heirs of autochthons. In fact, the most intelligent autochthons no longer sell; they instead propose some form of 'planting-sharing' of rubber. This is an arrangement between an owner turning over his land to a lessee who clears it and grows rubber. Both partners then share the plantation when it goes into production (Colin and Ruf 2011).

Nevertheless, an ever increasing number of migrants are diversifying into rubber by clearing coffee plants and cocoa trees, but without making the autochthons really assert their control over the land. In fact, even with rubber, the autochthons remain susceptible to quick cash gains through land sales. For example, in one of the first villages which benefited from the support of an agro-industrial rubber company in the form of a gift of selected planting material, the autochthons sold two-thirds of the plants to migrants. In fact, since the autochthons have sold forest lands in large quantities to migrants, they no longer possessed enough land and labour to plant everything. Since the 2000s, it is often migrants who become proponents of adopting rubber cultivation in the villages of the south-west (Fig. 2.19).

Migrants represent two-thirds of cocoa farmers in the country and over 90 % in Bas- Sassandra. After the autochthons, it is their entry into the rubber sector that is behind the country's rubber boom. Finally, the change of generation among the autochthons and migrants is also a factor in accelerating the felling of old cocoa trees and their replacement by rubber.

We will limit ourselves here to illustrating this through a plot map in the Agboville region, near Abidjan. Figure 2.20 shows a block of more than 20 acres which belonged to an autochthon of the area. This block consisted of cocoa trees, coffee plants and forests. Today the coffee plants have disappeared. The block has diversified into old and new cocoa plantations, recent rubber plantations and fallow land on which food crops rotate. The block is also fragmented in terms of usage and ownership, resulting from the division of the property through inheritance in favour of the original owner's three sons and the sale to a Senoufo migrant. This migrant first purchased part of the land from the father, and subsequently some more from the inheriting sons. Two

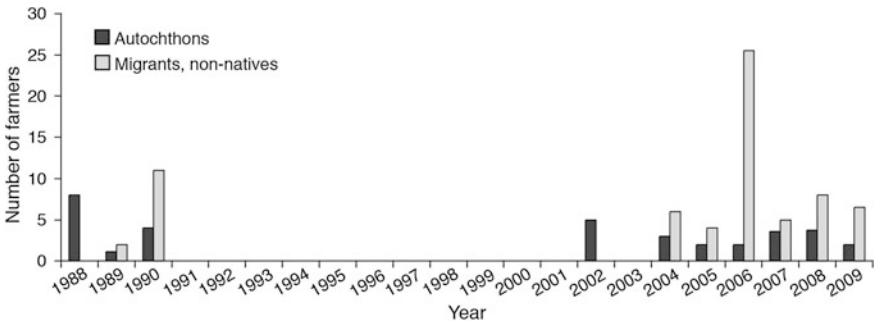

Fig. 2.19 Changes in the place of autochthons and migrants in the process of diversifying into rubber cultivation in 1988–2009. (Data collected in one village and from 41 farmers in the *département* of San Pedro. *Sources* Author's survey, 2011)

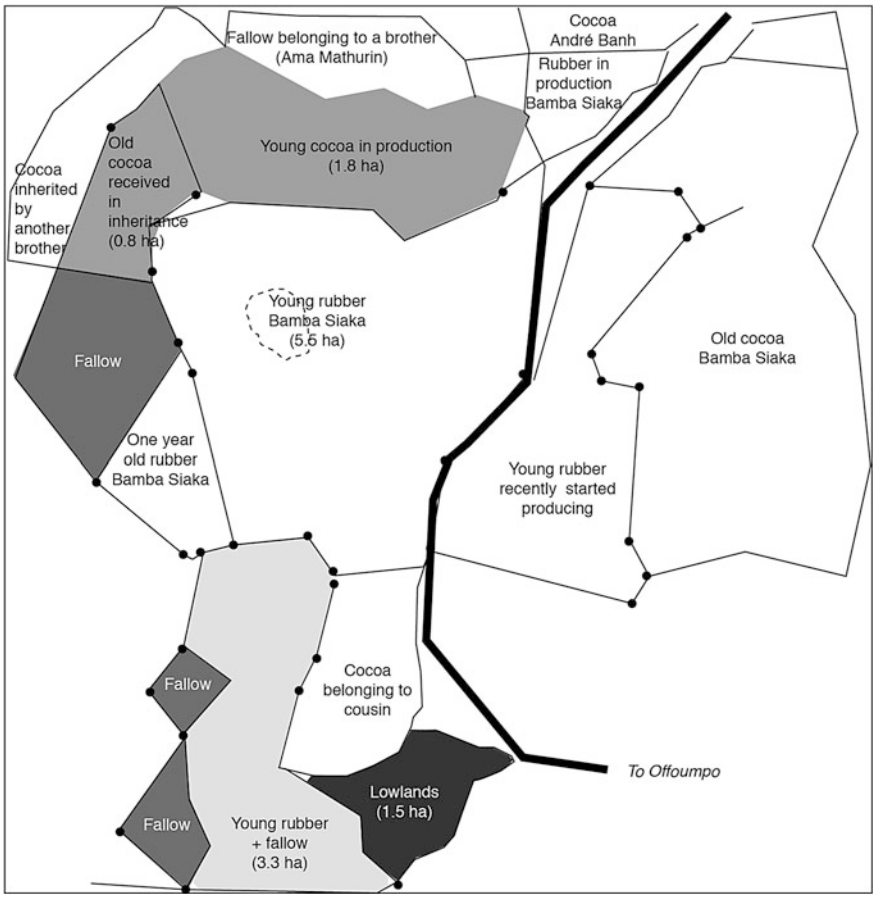

Fig. 2.20 Map of a block of plots dominated by cocoa trees, coffee plants and forests in the Agboville region

of the three sons sold a major part of their inheritances. Only one of the three, Ama, continued with a farm of about 8 ha by jumping on the rubber-cultivation bandwagon. Bamba, the migrant farmer is currently reconstituting a block of more than 20 ha. He is gradually adding to his land by purchasing plots without giving up cocoa cultivation, but he now accords priority to rubber, partially through the clearing of old cocoa trees which he buys and replants with rubber (Fig. 2.21).

This process of felling-replanting-diversifying very often accompanies a change of generation, inheritance or transfer through the land market. Interactions also take place between UMCI farmers and villagers. Even though Bamba, a village farmer and Senoufo immigrant, plays well the role of rubber-adoption pioneer amongst the villagers, it is partly thanks to information he obtains from a manager in charge of 100 ha of rubber plantations (Fig. 2.21). This sharing of information is facilitated by their common Senoufo origin.

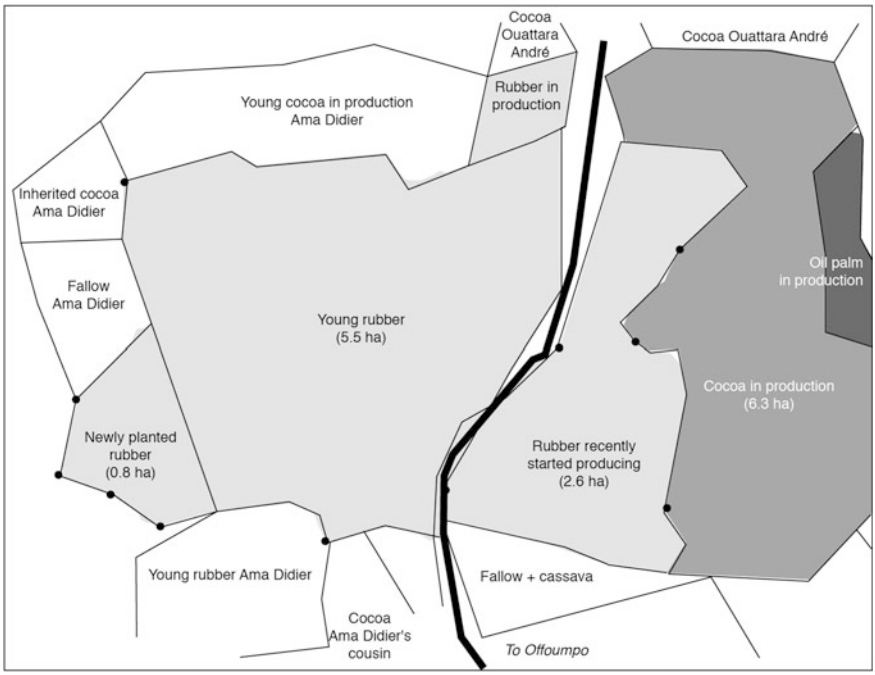

Fig. 2.21 Change in the block of plots after the process of felling-replanting-diversifying

2.7.4 Retirees, Young People and Changes in Generations

The villager-UMCI and autochthon-migrant dualism is complicated by changes in generations. Thus, many retirees from relatively modest professions, with available retirement benefits or capital, become villagers specifically to invest in rubber cultivation.

As far as young people are concerned, even if they start off with a small income or capital, often generated by an inherited plot of cocoa or by a first young cocoa plantation, their main goal remains to plant rubber as soon as possible.

2.7.5 Men and Women

Slowly but steadily, African women are gaining access to perennial crops. In Côte d'Ivoire, we have observed that projects developed by the private sector draw a much more encouraging reaction from women than from men. Most notably, a project set up by the Mars company and one from the World Cocoa Foundation (WCF) have helped to create or expand their cocoa plantations (Tables 2.15 and 2.16).

Table 2.15 Women growers and membership of the WCF's Cocoa Livelihoods Programme (CLP) project

Village	Project membership	Non-project	Total
Djangobo	16	0	16
Campement Bernard	8	0	8
Total	24	0	24

Table 2.16 Men growers and membership of the WCF's Cocoa Livelihoods Programme (CLP) project

Village	Project membership	Non-project	Total
Djangobo	14	21	35
Campement bernard	19	12	31
Total	33	33	66

2.8 Conclusion

Despite very high taxes on the cocoa sector, the very low prices that reigned between 2004 and 2008, a drastic reduction of extension services available to farmers and in spite of the alarm sounded by the chocolate industry, cocoa production in Côte d'Ivoire still remains very high: over 1.2 million tonnes were being produced annually at the start of the 2010 decade, even exceeding 1.5 million tonnes in some years, including in 2013–2014. This dynamic can be explained to a small extent by the desire of farmers to protect their cocoa heritage by the application of insecticides and a little fertilizer. But it is mainly due to the adoption of the universal model of cocoa economies: new migrations leading to massive clearing of protected forests. This happened in the forests in the west of Côte d'Ivoire, from where more than 300,000 tonnes of cocoa now come. A less significant factor has been the return to secondary forest and fallow to the east, as well as to the forest-savannah boundary in the country's centre.

Thus, in the early 2010s, the diversification/conversion processes undertaken in the old cocoa growing areas did not result in a statistical decline at the national level. The decline in the old regions did not appear in national statistics due to the boom in the new regions. This was, once again, the 'migration/clearing of forests' model at work, unfortunately mainly at the expense of protected forests and national parks.

In the old cocoa growing areas, smallholders were practically left to fend for themselves, without access to advice or technical assistance. Recently, the 'cocoa certification' programme, launched by the chocolate industry, has reintroduced some training and support. This movement has spread rapidly. In 2010, less than 5 % of the farmers had received certification but by 2013–2014, this figure had probably grown to 50 %. But there have been very many irregularities, with many middlemen and traders converting themselves into 'cooperatives' and certifying

growers who do not even know they are certified and thus have never received their certification premiums. More fundamentally, the techniques that have been disseminated are of uncertain and varying effectiveness (Ruf et al. 2013; Ruf and Bourgeois 2014).

Until 2005–2006, in all these old cocoa growing regions, investments in new cocoa plantations continued despite the arrival of rubber. Farmers wishing to adopt rubber first replaced their fallow lands and old coffee plants with it—which is what led to the accelerated decline of coffee in the 2000s. Only then did cocoa come into the crosshairs. Since 2009, the lure of rubber cultivation has increasingly gone hand in hand with lower cocoa yields, the fight against insect damage and diseases, and difficulties of replanting. It has led to the clearing of cocoa plantations or the cultivation of rubber in the understory of old cocoa trees waiting to be felled.

The rise of rubber cultivation, the most dramatic diversification of the early 2010s in Côte d'Ivoire, is thus explained by multiple factors which correspond well to the proposed diversification model: (a) ecological change, depletion of soils, pest and disease constraints, leading to a Boserupian mechanism of crop diversification; (b) appeal of the market with prices that had once again become very attractive, at least until 2012, and the regularity of income during the year; (c) economic policies that have largely favoured rubber cultivation, especially through the differential in taxation; and (d) opportunities offered by projects supported by the rubber agro-industry. These four major factors have clearly driven the diversification process at the national level (Chap. 7).

The social dimension of this dynamic is represented by the transition in a big way of 'established migrant farmers' (who had migrated in previous decades for planting cocoa) into rubber cultivation after overcoming the autochthons' resistance. New actors such as UMCIs, their farm managers and labourers have also played a major role in this diversification.

Land policy and the Rural Land Law of 1998 also contributed, indirectly, to the accelerated adoption of rubber since 2006. Migrants, threatened by the autochthons supported by the Gbagbo regime, feared that their fallow land would be seized and resold. Paradoxically, this land risk stimulated investment in tree crops and this is one of the reasons why migrants have shifted to cultivating rubber, despite resistance encountered from the autochthons. It is a classic paradox of the family plantation economy, at least in West Africa: a plantation or a perennial crop marks a certain right to the land and can therefore help remove ambiguity of the property's ownership. This principle was first supported by the policy of Houphouët-Boigny, way back in the 1960s, and the principle of 'the land belongs to those who work it' greatly enhanced the growth of cocoa. Even without this political factor, a perennial

crop remains a property marker, more difficult to challenge than an apparently uncultivated land,[3] even if it is being used to grow seasonal food crops in rotation.[4]

Will the fall of the Gbagbo regime in 2011, generally pro-autochthon (at least in its pronouncements), and the return of a generally pro-migrant government change the dynamics of the 2010 decade? Initial observations in 2013 suggest a further acceleration of rubber plantations by migrants, at least in the villages which had 'politico-autochthonous' blocks in place, for example, near Issia, where the former Minister of the Interior owned a large rubber plantation and enforced a ban on planting by non-autochthons. At the same time, due to the collapse of world rubber prices in 2013–2014 and an introduction of a new tax by the new regime, the 'rubber rent' has weakened in Côte d'Ivoire. This could moderate enthusiasm for investment in rubber in the days to come.

Nevertheless, the dramatic increase in rubber production, reaching a level of 300,000 tonnes of dry rubber in 2013, and predicted to reach a level of around 600,000 annual tonnes before 2020, has to be seen with respect to the unfolding of the cocoa cycle and the ecological changes it leads to: the soil degradation and the consumption of forest rent (Chaps. 6–9), which are offset by the rubber rent. Good growth of rubber on degraded and acidified soils, as well as its physiology, contribute to its impressive regularity of production and thus of income. They also contribute towards the potential for improving labour productivity, as well as the technological progress acquired with the creation and selection of improved clones over the last few decades. Thus, diversification into rubber in Côte d'Ivoire partly pertains to the technological advance over the cocoa sector (Chap. 7).

The world of cocoa and chocolate is well aware of all of this. In order to slow down the growth of rubber and revive cocoa productivity, a large section of the chocolate industry is today trying to introduce clonal material and fertilizer appropriate for cocoa cultivation. Will this trend lead cocoa farmers only to diversification or to a more gradual but complete conversion over 20 or 30 years? For many farmers, even more than markets and cocoa prices which need a serious stimulus, the answer rests on the ability of research and the chocolate industry to come up with technological advances applicable at low cost to solve the universal problems of cocoa replantation and rehabilitation. Despite significant resources being deployed by the chocolate industry, it remains a difficult challenge. Because of the new 'competitor', dwindling forests and pest pressure on cocoa (insects, diseases), it seems unrealistic to expect to find a solution in just a few years to a centuries-old problem. Some national institutes may also be reluctant to encourage the adoption of clones for fear of the spread of diseases such as swollen shoot, or more prosaically, for fear of losing their monopoly on planting material.

[3]This fundamental role of tree crops as markers of land ownership in Côte d'Ivoire has been widely analyzed by many social scientists (Gastellu, Affou Yapi, Schwartz, Lena, Lesourd, Chauveau, Dozon, Colin Léonard among others). Fallows, on the other hand, can be taken back by autochthons. It has also been identified in Ghana. (Goldstein and Udry 2008).

[4]This development is not, however, without dangers to medium-term food security (Chap. 7).

At the economic and institutional levels, the competition between agro-industrial sectors seems to be favourable to farmers in Côte d'Ivoire. In the Ivorian context, characterized by a phase when land, forest and labour resources have started becoming scarce, diversification is compelling the chocolate and cocoa industry to invest in their sector's upstream (supply of inputs and services to farmers) as well as its downstream (intervention with the government to influence price-tax-subsidy policies). It is imperative that these investments also encompass commercial aspects through contracts with farmers that are financially beneficial to them. For example, if the chocolate industry expects positive results from its programme of mass cocoa certification, it must ensure that the certification premiums are actually and regularly paid. And when they are paid, they have to truly reach the farmers without being misappropriated by intermediaries.

This type of support—in substance and not just in words—extended by agro-industry to producers is piquing the interest of the farmers and, perhaps, even providing them with motivation to diversify without resorting to conversion. From this point of view too, diversification is justified.

References

Aguilar P, Paulin D, Keho Y, N'kamleu G, Raillard A, Deheuvels O, Petithuguenin P, Gockowski J (2003) L'évolution des vergers de cacaoyers en Côte d'Ivoire entre 1995 et 2002. In: Proceedings of the 14th international conference on cocoa research. Accra, Ghana. pp. 1–167, 1–175, 18–23 Oct 2003

Chauveau JP (1993) L'innovation cacaoyère. Histoire comparée de la cacaoculture en Afrique de l'Ouest. In: Byé et Muchnick (eds) Innovations et sociétés. Quelles agricultures? Quelles innovations? Inra/Cirad/Orstom, Montpellier 1:43–58

Chauveau JP (2006) How does an institution evolve? Land, politics, intergenerational relations and the institution of the *tutorat* between autochthons and migrant farmers in the Gban region (Côte d'Ivoire). In: Kuba R, Lentz C (eds) Landrights and the politics of belonging in West Africa, Brill Academic Publishers, African Social Studies Series, Leiden, pp 213–240

Chauveau JP, Léonard E (1996) Côte d'Ivoire pioneer fronts: historical and political determinants of the spread of cocoa cultuvation. In: Claence-Smith WG (ed) Cocoa pioneer fronts since 1800: the role of smallholders, planters and merchants. Macmillan, London, pp 176–194

Cheyns E, Kouamé YS, Verdeaux B, Nai Nai S (2001) Adoption du matériel végétal et itinéraires techniques en plantations villageoises de palmier à huile. In: Assamoi Y, Burger K, Nicolas D, Ruf F, De Vernou (eds) Proceedings of the conference on the future of perennial crops, Yamoussoukro. Cirad, BNETD, ESI-VU, Montpellier, 5–9 Nov 2001

Cheyns E, Rafflegeau S (2005) Family agriculture and the sustainable development issue: possible approaches from the African oil palm sector. The example of Ivory Coast and Cameroon. Oléagineux, Corps Gras, Lipides (OCL), 12 (2):111–120

Colin J-Ph (1990a) La mutation d'une économie de plantation en basse Côte d'Ivoire. Paris, ORSTOM, 284 pp. plus annexes

Colin J-Ph (1990b) La dynamique des systèmes productifs agricoles en basse Côte d'Ivoire. In: Dynamique des systèmes agraires. La dimension économique. Orstom, CNRS, Paris, pp 165–190

Colin JP (2008) Étude sur la location et les ventes de terres rurales en Côte d'Ivoire. Rapport 1. Diagnostic des pratiques. Abidjan: République de Côte d'Ivoire, ministère de l'Agriculture, Délégation européenne

Colin JP, Ruf F (2011) Une économie de plantation en devenir. L'essor des contrats de planter-partager comme innovation institutionnelle dans les rapports entre autochtones et étrangers en Côte d'Ivoire. Revue tiers- monde, (207):169–187
Couty P (1989) Risque agricole, périls économiques. In: Eldin M, Milleville P (eds) Le risque en agriculture. Orstom, Paris, pp 561–568
Djkman MJ (1951) Hevea: thirty years of research in the Far East. Coral Gables. University of Miami Press, Miami, Florida
Gastellu JM (1979) Disparition de la main-d'œuvre étrangère. Cahiers du CIRES (23):17–45
Gastellu JM (1982) Une économie du Trésor: les grands planteurs du Moronou. Abidjan: ORSTOM, 119 pp
Goldstein M, Udry C (2008) The profits of power: land rights and agricultural investment in ghana. J Polit Econ 116(6):981–1022
Hermann E (1981) Analysis of selected agricultural parastatals in the Ivory Coast. Analytical study prepared for USAID
IRCC (1979) Étude de la boucle du cacao. Centre de recherche de Côte d'Ivoire. Bingerville, 42 pp
Léna P (1979) Transformation de l'espace rural dans le sud-ouest ivoirien. Thesis in Geography, Orstom, Abidjan, Côte d'Ivoire, 345 pp
Léonard E (1997) La reproduction de la société agraire dans la région de Sassandra. In: Guillaume A, Ibo J, Koffi NG (eds) Croissance démographique, développement agricole et environnement à Sassandra. Orstom, pp 137–160
Léonard E, Vimard P (eds) (2005) Crises et recomposition d'une agriculture pionnière en Côte d'Ivoire. Dynamique démographique et changements économiques dans le bas-sassandra. IRD-Karthala, Paris, 368 pp
Losch B (1990) La filière caoutchouc naturel en Côte d'Ivoire: originalité et enjeux. In: Griffon M (ed) Économie des filières en régions chaudes: formation des prix et échanges agricoles. Actes du X^{e} Séminaire d'économie et de sociologie, Montpellier, France, Montpellier: Cirad, pp 785–804, 11–15 Sept 1989
Mehra S, Weise S (2007) West Africa strategy, WCF Partnership Meeting Amsterdam, 28 pp. www.worldcocoafoundation.org/who-we-are/partnership-meetings/pdfs/WestAfrica Strategy.pdf. Accessed 23 May 2007
Mollard E (1993) La différenciation spatiale de l'Économie de plantation. Mappemonde 2:45–47
Naï Naï S, Cheyns E, Ruf F (2000) Adoption du palmier à huile en Côte d'Ivoire. OCL 7 (2):155–165
Oswald M (1997) Recomposition d'une société au travers de plusieurs crises: la société rurale Bété (Côte d'Ivoire). Doctoral Thesis, INA-PG, 290 pp + annexes
Ruf F (1984) What intensification for the ivory coast plantation system? History, farming systems and agricultural policy. L'Agron Trop 39(4):367–382
Ruf F (1987) Éléments pour une théorie sur l'agriculture des régions tropicales humides. I - De la forêt, rente différentielle au cacaoyer, capital travail. *Agronomie tropicale*, 42(3):218–232
Ruf F (1988) Stratification sociale en économie de plantation ivoirienne. Thèse de doctorat, université de Paris X, Nanterre, 6 vol 1393 pp
Ruf F (1993) Adoption et abandon du cacaoyer: cycles d'innovations et ajustements. In: Chauveau JP, Yung JM (eds) Innovations et sociétés. Quelles agricultures, quelles sociétés?, Vol 2 Les diversités de l'innovation CIRAD, INRA, ORSTOM. Montpellier, pp 337–346
Ruf F (1995) Booms et crises du cacao: les vestiges de l'or brun. Karthala (ed) Collection Économie et développement, Paris 455 pp
Ruf F (2006a) Éléments d'une stratégie d'amélioration du peuplement végtal des plantations pérennes paysannes en zone forestière de Côte d'Ivoire, vol 2, La demande en matériel végétal et son utilisation par les planteurs. BDPA and Cirad, 220 pp
Ruf F (2011a) Pareto en Côte d'Ivoire. Cycle du caoutchouc et concentration foncière. In: Jul-Larsen E, Laurent PJ, Le Meur PY, Léonard E (eds) Une anthropologie entre pouvoirs et histoire. Conversations autour de l'œuvre de Jean-Pierre Chauveau. Karthala, Paris pp 59–91
Ruf F (2012) L'adoption de l'hévéa en Côte d'Ivoire. Prix, mimétisme, changement écologique et social. Économie rurale, (330–331):103–123

Ruf F, Akpo JL (2008) Étude sur les revenus et les investissements des producteurs de café et de cacao en Côte d'Ivoire. Report to the European Union.. Cardno Agrisystems, Abidjan, Côte d'Ivoire, 90 pp

Ruf F, Bourgeois M (2014) Pénurie de cacao? Agro-industrie et planteurs villageois. www.inter-reseaux.org/ressources-thematiques/les-notes-d-inter-reseaux/article/penurie-de-cacao-agro-industrie-et

Ruf F, N'DaoY, Lemeilleur S (2013) Certification du cacao: stratégie à hauts risques. Inter-réseaux. http://www.inter-reseaux.org/ressources-thematiques/article/forum-certification-du-cacao

Schwartz A (1979) Colonisation agricole spontanée et émergence de nouveaux milieu sociaux dans le sud-ouest ivoirien: l'exemple du canton bakwé dans la sous-préfecture de Soubré. Cahiers ORSTOM, Ser Sc Hum, XVI(1–2):83–101

Schwartz A (1993) Sous-peuplement et développement dans le sud-ouest de la Côte d'Ivoire. Cinq siècles d'histoire économique et sociale. Orstom, Coll. Études et Thèses, Paris, 490 pp