# Chapter 16
# Diversification and Perennial-Crop Cycles in Aceh, Indonesia

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Aceh province, spread over an area of 55,392 km$^2$, is located on the northern-most point of the island of Sumatra and therefore at the top of the Indonesian archipelago. The history and politics of Aceh reflect this geographical marginality. The central government and the Suharto regime appropriated the revenue from large gas reserves discovered in 1971 at Arun. This prompted the people of Aceh to revolt in 1976 and found the Free Aceh Movement (GAM[1]) to push for political independence and reclaim their right to gas revenues. Several years of violent clashes between GAM and the Indonesian army followed. This situation often made it extremely difficult for the villagers to cultivate their farms. GAM and the government finally signed a peace accord in August 2005.

Aceh province is also known for the catastrophic tsunami of December 2004. While it resulted in a massive loss of human life and damage to property in the province, it also served as a catalyst to the resolution of the conflict (Hyndman and Waizenegger 2010). Not only have the villagers and villages in Aceh seen trying times in the recent past, they have also suffered through a long period of isolation from the rest of Indonesia. Nevertheless, cocoa production has increased steadily in recent years. In spite of all the geographical and historical circumstances, visitors travelling on roads in the north of the province come across a typically Indonesian landscape on the plains of the Pidie and Pidie Jaya districts: vast and perfect rice

[1]GAM: *Gerakan Aceh Merdeka* or Free Aceh Movement, which fought for the independence of Aceh for almost 30 years.

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paddies, whose continuous stretches are broken by the traditional *pekarangan*, agroforestry gardens, dominated by *pinang* (areca nut palm) and coconut trees that tower over rural homes. As they approach the villages, they can see cocoa plantations that seem aged and unproductive. Villagers complain of increasing difficulties related to the age of the trees and damage caused by squirrels and insects. Researchers have confirmed these growing problems and their negative impact on production and bean quality (Adi Prawoti et al. 2008; Jacquet and Paulin 2006, 2007). In addition to these cocoa systems, visitors will also observe occasional diversification towards oil palm monoculture. Finally, they come to clonal rubber plantations in the district of Aceh Tenggara.

Aceh province thus exhibits all possible types of diversification; it has agroforestry as well as monoculture plots. This situation on the plains, however, seems to contradict the data on cocoa production which is increasing in Aceh. Where then is the recent movement of diversification to cocoa? As we leave the roads and plains and move up the hills, the landscape presents fewer cocoa-based agroforestry plots and begins to sport more monoculture systems, until we reach the agricultural frontiers. Young cocoa plantations and slash-and-burn plots are moving forward at the expense of the forest.

This conflict between the plains and the hills seems to confirm this book's central hypothesis: the diversification process intervenes mainly where a perennial crop ages, like a preferred response to essential biological and ecological changes associated with aging cocoa and the unfolding of its life cycle. In the case of Aceh, without forgetting for a moment the influence of its particular history of the war years which were very hard for the villagers, how does this biological determinism play out in interaction with the market, public policies and initiatives of private groups?

## 16.1 Location of the Studies and Methodology

A preliminary observation was made in 2008, as part of a project of the Indonesian Research Institute for Estate Crops (in Indonesian: *Lembaga riset perkebunan Indonesia*, LRPI) and CIRAD. The project sought to revitalize cocoa production and quality, mainly in Pidie district. Short interviews were conducted with 30 smallholders, mainly on their strategy for the adoption of cocoa cultivation. A study was then conducted in 2010 in two districts (Pidie Jaya and Aceh Tenggara) in conjunction with another project aimed at re-launching cocoa cultivation in Aceh that was undertaken by the NGO Swisscontact. Sixty farmers were surveyed to determine the perceptions of villagers regarding the project, and to understand the characteristics of their farms (Fig. 16.1).

Pidie and Pidie Jaya, situated in the northern part of Aceh province, bordering the Strait of Malacca, were severely affected by the conflict between GAM and the army. Their coastline also bore the brunt of the 2004 tsunami. The people of Pidie Jaya are predominantly indigenous, with very few immigrants from other districts or provinces. In fact, Pidie and Pidie Jaya have witnessed a sizeable emigration to


**Fig. 16.1** Map of Aceh province. (*Source* www.eastwestcenter.org)

other districts or provinces, mainly of men who were forcibly conscripted by GAM or who wanted to escape conscription.

Aceh Tenggara is a district in the southern part of Aceh province. It looks like a ribbon of plains wedged between two mountain ranges that are classified as

protected areas (Leuser and Bukit Barisan national parks). Aceh Tenggara is a district that has attracted immigrants for a long time now. Indigenous people here are called Alas,[2] and immigrants are people of various ethnic origins (Batak,[3] Gayo,[4] Jawa,[5] etc.).

The district draws migrants because of its location (bordering North Sumatra province), well-known for soil fertility and land availability (low population pressure).

A qualitative approach has been adopted for the study, based on qualitative surveys with 90 farmers (30 in each of the three districts).

## 16.2 Results and Discussion

### *16.2.1 Diversification to Cocoa*

Statistics confirm an increase in cocoa production in Indonesia from 17,000 tonnes in 2007 to 26,000 tonnes in 2009. The production of rubber and oil palm are also on the increase. Coffee production, which was thought to have stabilized between 100,000 and 110,000 tonnes over the past decade has, however, declined to less than 40,000 tonnes in 2009. It should be noted that these statistics are subject to several errors. For example, they do not take into account the transfer and marketing of production from one province to another. Nonetheless, these trends reveal a reality of a strong growth of cocoa cultivation, a small growth in rubber, a large increase in areas under oil palm cultivation and a decline in coffee. Granted that these three districts studied are not representative of all the crops but even if one crop such as the oil palm has originated from large private plantations, we will be able to discern these trends and attempt to explain them on the basis of diversification decisions taken by farmers.

Cocoa cultivation was introduced to Pidie and Pidie Jaya by a private plantation in the mid-1970 s and was adopted by smallholders in the 1980s. It was adopted in Aceh Tenggara a decade later, in the 1990s. Surveys conducted in 2008–2010 confirmed that cocoa was adopted in all the three districts, and thus indicate a dynamic of diversification towards cocoa in recent years (Figs. 16.2 and 16.3).

[2]Alas: original people from Aceh Tenggara (Alas ethnic group).

[3]Batak: person of the Batak ethnic group, a native of North Sumatra province.

[4]Gayo: person from Gayo Lues district, north of Aceh Tenggara in Aceh province.

[5]Jawa: person from the island of Java.

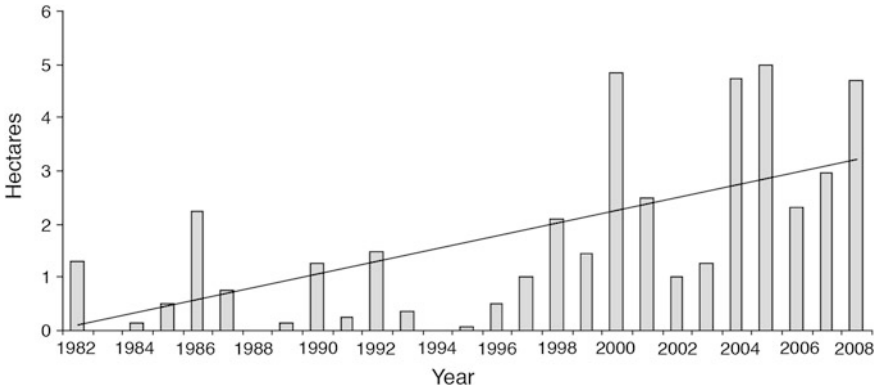


**Fig. 16.2** Number of cocoa plantations established by villagers in Pidie district between 1982 and 2008. (*Source* Survey by authors 2008)

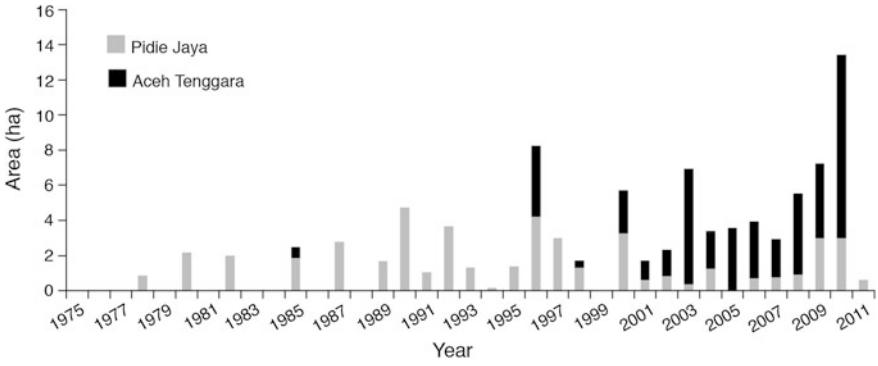


**Fig. 16.3** Number of cocoa plantations established by villagers in Pidie Jaya and Aceh Tenggara districts between 1978 and 2010. (*Source* Survey by authors 2011)

#### 16.2.1.1 Pidie and Pidie Jaya

The agricultural system present in these two districts was diversified at the farm and plot levels even before cocoa was introduced here. In the context of an armed conflict, families continued to cultivate rice and food crops (maize, soybean, groundnut, chilly and vegetables), which satisfied their food needs and also earned them a little income. Furthermore, more market-oriented perennial crops were intercropped in these plots: Areca palm (areca or betel), coconut, clove, nutmeg and various fruit trees.

Simultaneous Diversification at the Level of the Plot, Farm, Region

Starting in the 1980s, cocoa began to be introduced into existing cultivation systems: under Areca palms, coconut and fruit trees (durian, rambutan, etc.). Cocoa

**Table 16.1** Crops preceding cocoa in Pidie Jaya

| Crops preceding cocoa | 1980–1985 | 1986–1990 | 1991–1995 | 1996–2000 | 2001–2005 | 2006–2010 | Total |
|---|---|---|---|---|---|---|---|
| Perennial crops/insertion into an agroforestry system (%) | 40 | 9 | 27 | 40 | 38 | 20 | 26 |
| Forest (%) | 60 | 83 | 55 | 53 | 38 | 60 | 59 |
| Food crop plots (%) | – | – | 18 | 7 | 12 | 7 | 9 |
| Fallow with *Imperata* (%) | – | 8 | – | – | 12 | 13 | 6 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

*Source* Survey by authors 2011

trees thus became integrated into a diverse agroforestry system at the plot level (Table 16.1).

At the same time and subsequently, cocoa trees were also planted after clearing of forest lands, away from roads, on the hills—this is the prevalent planting method. While young, cocoa trees can be intercropped with banana trees (the former gets shade and the farmer gets a marketable product) and other food crops such as cassava, vegetables and groundnuts. After 2 or 3 years, when the cocoa is grown, the system evolves towards plantations with a simple association with bananas, then, finally, to a monospecific one. In this case, diversification takes place no longer at the plot scale, but at the level of the farm or the landscape.

Farmers can also revert to a diversification at the plot level by reproducing agroforestry systems, by intercropping Areca palms with cocoa in the same year. Some agricultural experts on cocoa believe that an association between Areca palm and cocoa is not good for managing soil fertility. In fact, the Areca palm consumes a substantial amount of soil minerals without any significant recharge as compared to other species: few leaves fall to the ground, and those that do take time to degrade. However, the association seems effective in terms of light management as the two trees occupy different canopy layers: Areca palms grow rapidly to more than 20 m and provide a moderate shade for cocoa trees, which generally do not grow taller than 3 m. While benefitting from this complementarity, the farmers' strategy is to diversify market risks.

On the other hand, coffee is gradually being phased out and is being replaced by cocoa. Coffee, in fact, requires more work and occupies the same agroforestry canopy level as cocoa. Moreover, it is attacked by an insect. Likewise, cloves are also being phased out due to disease (Box 16.1).

Diversification into cocoa can thus take various forms and different types of cropping systems. It also reflects the influence of several determinants.

**Box 16.1. Smallholder diversification itineraries**
In the 1970s, Muhamad N. was primarily a clove and coffee farmer in the village of Ulle Gunung, Pidie district. Both were primary crops in the region, until they were attacked by pests and disease. Clove trees which provided the shade for coffee were the first to be affected, followed by the coffee plants themselves.

It was thanks to the planting material provided for free by extension services in 1990 that Muhamad N. grew cocoa, replacing clove and much of the coffee. The plot, however, remained an agroforestry system with Areca palms and fruit trees.

However, according to Muhamad N., tens of hectares of cocoa were being established by clearing the forest behind the mountains. Access remained difficult and visitors were not always welcome (Survey by authors 2008).

### Role of Public Policy

The majority of those who adopted it early readily affirm that cocoa was introduced through a project of the extension services in 1982. In fact, that was the year when a national project was launched in several provinces to promote cocoa cultivation by handing out subsidies (cocoa planting material and grants for tools, sometimes even in cash). This project, generally speaking, had little impact, except in specific areas where smallholders had started adopting cocoa a few years earlier, mainly in Sulawesi (Ruf and Yoddang 2004). In the case of Aceh, with the start of hostilities between GAM and the Indonesian military in 1976, the central government and extension services viewed the promotion of cocoa cultivation as a means of consolidating their influence over the villagers.

Nevertheless, social pressure in the village was palpably obvious behind these pro-government interactions. During interviews, many farmers eventually recognized other factors in adopting cocoa, mainly the availability of information and planting material, which are major enablers of diversification.

### Plantation Companies

The transfer of planting material from an industrial plantation to the village by villagers hired as labourers, with or without the knowledge of the plantation company, is a widespread factor in the adoption of a new crop, and thus of diversification. From the time coffee came to Sumatra, during the colonial period, to the arrival of cocoa in Central Sulawesi in the 1990s, we have often observed this type of unplanned diversification. It is induced by rural labourers who ‘divert’ some of the planting material for planting in their villages (Ruf and Yoddang 2000). Indeed, the

private company PT Gotong Royong was one of the first to plant cocoa in Aceh in the 1970s (in the Ulim sub-district, Pidie). A section of the villagers working in the plantation were the first to try out cocoa cultivation in their own farms.

### Individual Initiatives, Migrants, NGOs and the GAM Rebellion

The private plantation of PT Gotong Royong is probably one of the few large cocoa plantations in Aceh, even though the neighbouring province of North Sumatra had several. According to the surveys, the first person to have planted cocoa was a native of Medan, the capital of North Sumatra province. This Javanese farmer had observed cocoa cultivation and its profitability in the Medan area. When he moved to Pidie Jaya to work in the construction sector, he planted cocoa trees and encouraged his neighbours to do the same.

Furthermore, four villages in Pidie (Kambo Nica, Kambo Peapi, Senadi and Blang Unci) received planting material and assistance through a project funded by Japanese aid in 1998.

Finally, at least in Pidie, the villagers from Alue Glumpong mentioned receiving plants distributed by GAM members in the 1990s. This unexpected role of the rebellion, at least by some of its members, illustrated the significance of agricultural extension for officials involved in a territory's governance. It was a matter of gaining influence over the rural population. This is one of the aspects of the interaction between public policies and diversification.

### Life Cycles of Perennial Crops and Ecological Change

Planting material and information on cocoa were progressively used in a context of environmental change. At the time when cocoa was introduced in Aceh, clove cultivation was afflicted by disease, leading to a decline in production. Farmers were looking for a solution. There was also the impact of insect damage on *Arabica* coffee, at least in Pidie (Box 16.1).

### Interaction Between the Market and Policies

Several mechanisms pertaining to prices and income combined with ecological change and plant physiology. They contributed to diversification towards cocoa, even a partial replacement of clove and coffee by it. This was a process observed in several parts of Indonesia, especially Sulawesi (Ruf 1995, 2000). These mechanisms were also observed in Aceh:

- in the 1990s, the procurement price of cloves paid to producers across Indonesian provinces collapsed as a result of a stabilization fund imposed by the son of President Suharto. Revenue from clove soon became lower than that from cocoa (Fig. 16.4);

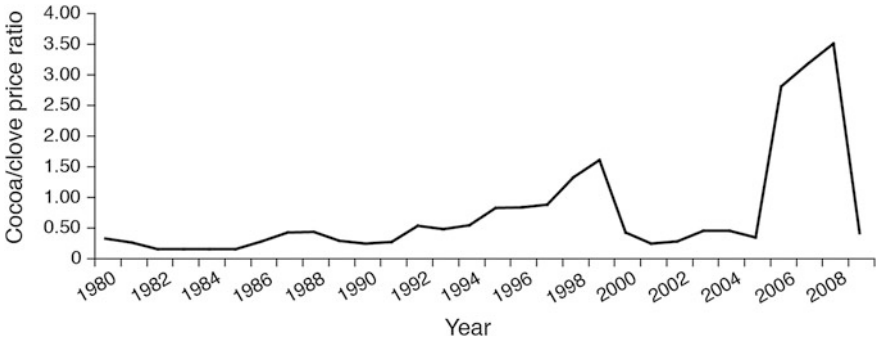


**Fig. 16.4** Cocoa/clove price ratio in Indonesia, 1990–2009. (*Source* FAO stat)

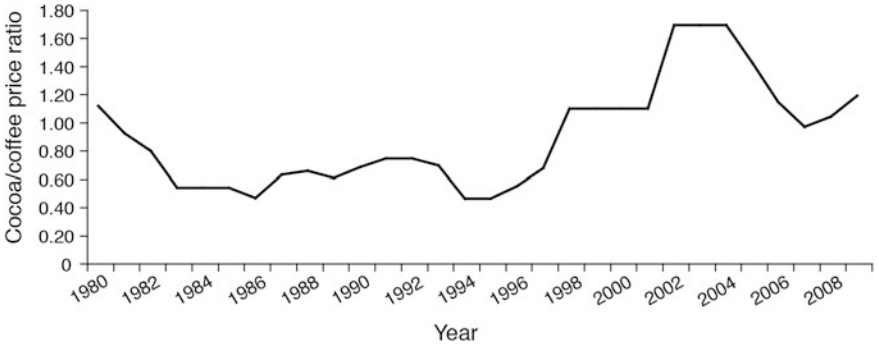


**Fig. 16.5** Cocoa/coffee price ratio in Indonesia, 1990–2009. (*Source* FAO stat)

- except for a brief period between 1994 and 1996, the ratio between cocoa and coffee prices increased (Fig. 16.5);
- regularity of income. Clove and coffee could be harvested only once a year, at least in Aceh. This resulted in difficulties in managing income. Cocoa brings in a certain income monthly due to the conditions of regular rainfall prevalent in Aceh;
- finally, clove harvesting, which is done on ladders, is dangerous. Coffee harvesting work is considered long and tedious. In contrast, harvesting work for cocoa, when it is not affected by pests and disease, is considered very easy.

## Effects of Imitation

Following the economic success of the early adopters of cocoa, manifested primarily by the construction of new houses, the other villagers followed suit. Since cocoa comes into production only after 3 or 4 years, this typical process of imitation

took 5–10 years. Thus, the great imitation wave occurred between 1987 and 1990 since the pioneers had planted cocoa in the early 1980s.

With the conflict intensifying in Pidie Jaya after 1990, planting activities became erratic. They often slowed down when the intensity of the conflict rendered access to plots difficult and picked up when things were quieter. Cocoa plantations accelerated in 2000 in spite of a flare-up of the conflict between 2002 and 2003 in some districts (Figs. 16.2 and 16.3). The revival of cocoa production was brought about mainly by relocating the cocoa production areas towards the hills.

### Process of Relocation of Production Areas

By 2011, many forest plots were already cleared and burned in the interior regions (for example, near Jijem village, on the hills west of Pidie Jaya district). They were ready for or had already been planted with cocoa, such as the agricultural frontiers. New cocoa plantations were set up almost without shading.

Farmers or their son set up *pondoks* on their plots. These are big cabins which serve as second homes when they work for several days on their plots. This was not limited to farmers from Jijem village alone; farmers from other villages up to 15 km distant from Jijem and up to the plains also participated.

An Aceh native, even if he was from a different village, could easily acquire land here, often through a simple authorization from the village chief to clear forest land. Migrants other than Aceh natives could not acquire land in this manner; they therefore had to purchase it.

Many farmers were willing to move away from their homes to obtain land near Jijem and plant cocoa. The benefits of this extraction of value from cocoa added to the reasons for moving away from the plains: the soil of a forest patch that has just been cleared is considered to be very rich. In addition, these frontier areas did not yet have problems of disease or pests (except of monkeys, on forest edges).

In addition, clearing a forest plot accords a kind of a right to the property, provided that that forest land was never cleared before. This means that it is continuously necessary to move deeper into the hills.

In this process of relocation of the cocoa production areas, we come across the twin phenomenon of seeking a forest rent and a kind of land rent (Ruf 1987, 1995). Many of the farmers in Jijem who appropriated new forest plots in the hills were already cocoa growers. These farmers had often abandoned their old plantations on the plains.

### Population Growth and Generation Change

This process of relocation of cocoa production areas was given further impetus by population growth and generation change. Most of the young villagers who were interested in cocoa attempted to establish plantations in the hills (Box 16.2).

**Box 16.2. Examples of the combination of the 'young farmer—young plantations' cycles**

Thirty-year-old M.A., currently a technician with the Peka cocoa rehabilitation project, is a farmer in Pidie Jaya. This project could help him with his old 1 ha agroforestry plantation in the village which he inherited from his father. However, he has just cleared a forest patch in the hills to establish a 1 ha plot with young cocoa.

N.M., a 28 year old farmer in Jijem, in the hills of Pidie Jaya, negotiated to acquire a 3 ha plot of forest with the village chief in 2009. He benefitted from the fertility of the soil following a slash-and-burn process to get a good crop of rice and soybean, even as the young cocoa trees were growing well. His main tool now is the brush cutter. His primary objective is to fund his wife's studies at the University of Banda Aceh (Survey by authors 2011).

#### 16.2.1.2 Aceh Tenggara

The process of diversification towards cocoa is similar to those observed in Pidie and Pidie Jaya. Before cocoa cultivation was adopted in Aceh Tenggara, the main crops were rice, maize and perennial crops like candlenut, coffee (*Arabica* and *Robusta*) and clove. These three perennial crops are often intercropped on the same plot. Like in Pidie, farmers discontinued clove once it was affected by disease; they first replaced it with candlenut and coffee, before introducing cocoa. However, some older farmers mentioned that cocoa came to Aceh Tenggara much before it was brought to Pidie Jaya: they remembered it from their childhood, towards the end of the colonial period. Cocoa trees were brought by the Dutch and were, at that time, merely seen as ornamental tree which also produced a bean covered with candy-like sweet mucilage that children liked.

On the plains, near homes, cocoa was also grown as an agroforestry tree, intercropped with fruit trees that were either older than cocoa (durian, coconut, jackfruit, rambutan, banana) or of the same age (Areca palm).

In 1990, an employee of the agricultural extension service brought home, on his own initiative, some cocoa plants for trial. He planted some on his plots and gave away some to other farmers in his village. In 1991, the extension service took up the movement, and implemented a project to promote cocoa. As part of this project, it distributed planting material, disseminated information on how to grow the crop and, sometimes, even gave out a few tools and subsidies. Despite this, only a few villagers chose to play the role of pioneers in planting cocoa; most of the farmers knew nothing about the crop, and no cocoa market existed locally. To compound this, world cocoa prices were at their lowest at the time.

From 1994, the imitation effect started to work. Prices and incomes had a marked effect starting in 1997, even as the Asian currency crisis (*krismon* in

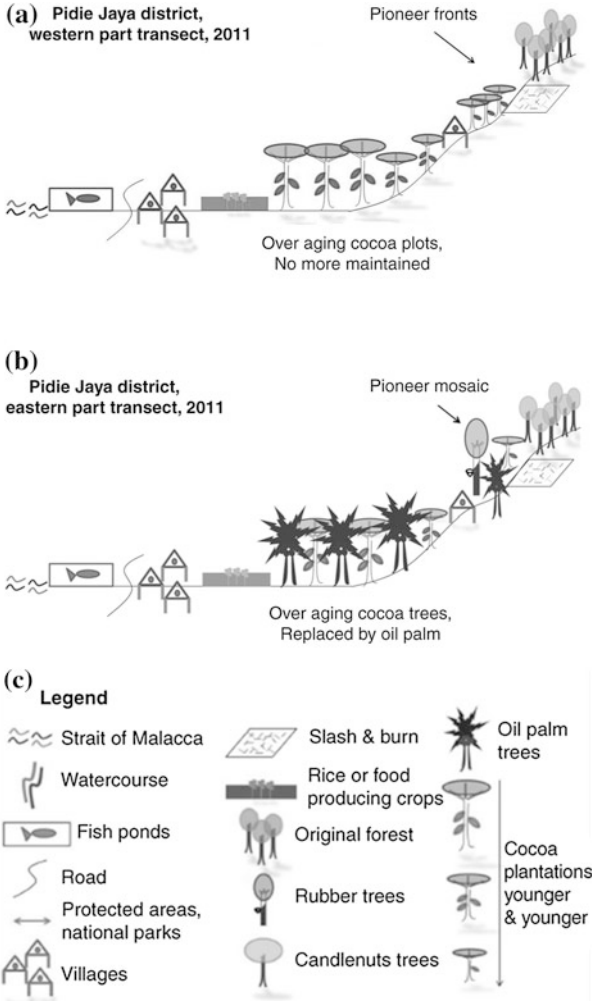


**Fig. 16.6** Landscape transects west and east of Pidie Jaya. (*Source* Paul 2011)

Indonesian) greatly favoured export-oriented agriculture, that of cocoa in particular. In the 1990s, the situation in Aceh Tenggara was less conflictual than in Pidie and Pidie Jaya, and villagers here could easily go about their fields and plant cocoa, replacing not only clove and coffee (Fig. 16.4), but also the rubber trees in the district. More recently, cocoa trees, planted in almost exclusive monocultural plots, were being planted at the expense of forest and food crops, especially rice (Table 16.2 and Fig. 16.7).

Despite a decline in interest due to the difficulty in controlling cocoa pests and diseases, farmers continued to invest in cocoa in 2011, on valley floors, instead of rice or on mountain slopes. Moreover, these slopes were most often located in

**Table 16.2** Crops preceding cocoa in Aceh Tenggara

| Crops preceding cocoa | 1980–1995 | 1996–2000 | 2006–2010 | Total |
|---|---|---|---|---|
| Perennial crops/insertion into an agroforestry system (%) | 100 | 86 | 59 | 62 |
| Forest (%) | – | – | 15 | 13 |
| Food crop plots (%) | – | 14 | 21 | 19 |
| Fallow with *Imperata* (%) | – | – | 6 | 5 |
| Total | 100 | 100 | 100 | 100 |

(*Sources* Survey by authors 2011)

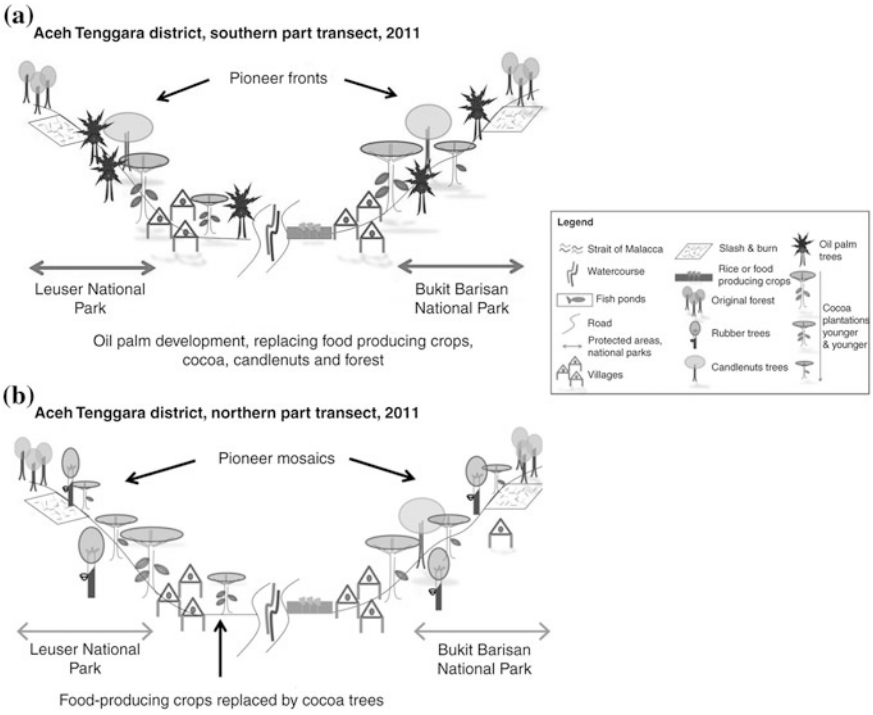


**Fig. 16.7** Landscape transects south and north of Aceh Tenggara. (*Source* Paul 2011)

protected forests and national parks (Table 16.2). However, it still seemed easy enough for indigenous people and even the sons or grandsons of migrants to acquire land in the mountains. Here too, it sufficed for villagers to get the permission of the village chief to clear forest areas. Sometimes, even this authorization was not necessary.

The partial conversion of paddy fields or *sawah*[6] to cocoa, which constitutes a kind of diversification as the conversion is partial, was due to several reasons according to the farmers:

- irrigation became difficult;
- income from rice is lower than that from cocoa;
- there was no more uncultivated land available near some villages for planting cocoa;
- uncultivated land that was privately owned by villagers (those who had cleared it or their inheritors) could still be found near the village. If a farmer wished to acquire such a plot, he had to buy it.

To overcome the obstacle of start-up land rent, farmers had to move ever further into the mountains. The work there was all the more difficult as they had to travel to the plot, usually on mountainous terrain. Some farmers, therefore, chose to convert their *sawah*, which is often close to the village, to cocoa.

Nevertheless, the largest share of cocoa production came from the hilly areas after forests had been cleared. Cocoa buyers confirmed these observations. The process of relocation of production areas remained dominant.

## *16.2.2 Diversification from Cocoa to Other Perennial Crops*

### 16.2.2.1 Pidie and Pidie Jaya

Opportunities for Diversification

Villages on the plains near the coast no longer seemed to be interested in their, often aging, cocoa trees. Several plantations seemed to be in a state of neglect. Farmers attributed this to the growing number of rodents, pests and diseases: squirrels, pod borer and black pod (*Phytophthora*, a fungus responsible for cocoa pod rot). Cocoa yields decreased with age of the tree, even as they required ever-increasing maintenance.

The effort put in maintaining an agroforestry system can be justified and funded by the income from several trees—for example, Areca palms and coconuts here—in addition to cocoa. However, even in these systems that could theoretically have balancing factors, the cocoa grown on the plains in Aceh is not immune to the 'end of the cycle' principle and the spiral of recession.

The universal strategy of relocating production areas towards the forest is still the predominant solution adopted in Pidie Jaya. Re-diversification to another perennial crop, by replacing cocoa, is rarely seen in the western part of this district

[6]*Sawah:* lowlands on which Indonesians grow rice in the rainy season (or all year round if the *sawah* is irrigated) and other short-cycle crops in the dry season.

because access to forests in the hills is relatively easier here (Fig. 16.6, western transect).

By contrast, a process of re-diversification to oil palm could start in the district's eastern part. In fact, cocoa farmers of the sub-districts more to the east have opted for oil palm. The opportunity was provided by a private plantation, the same one that introduced cocoa to Pidie and Pidie Jaya in the 1970s. The private plantation is currently replacing its old cocoa trees with oil palms. When this survey was conducted in 2011, about 70 ha were already planted with oil palm.

#### 16.2.2.2 Explanation by Farmers: Available Capital

Farmers expressed the determinants of diversification very clearly. Cocoa cultivation can be adopted with little capital as long as forest land is available and accessible. Indeed, establishing a cocoa plantation is not an expensive proposition if farmers can acquire forest land by clearing it, and then get cocoa planting material from extension services or, alternatively, from their first plantations. Besides, fertilization of cocoa plantations is not crucial, especially if they benefit from the forest rent.

On the other hand, for oil palm, hybrid plants and fertilization seem almost indispensable to farmers. This requires capital for investment and operating costs. The diversification process can be taken up, especially if a private company provides support. We find exactly the same processes in Western and Central Africa (Chaps. 2–10).

#### 16.2.2.3 Aceh Tenggara

When this survey was being conducted, in mid-2011, interest in cocoa was waning due to frequent insect attacks and price fluctuations. The total production in the district had been falling for 2 or 3 years (according to cocoa buyers).

Even though some villagers continued to plant cocoa, they also turned to other crops, mainly rubber. Several farmers who have been 'discouraged by cocoa' chose to either expand their farms by planting rubber, or by replacing cocoa by rubber. In such a case, the process of replanting and diversification is progressive and is partly based on an agroforestry technique: the principle of relay cultivation. They intercrop rubber trees with cocoa trees, and cut down the latter when rubber trees enter into production.

Among the benefits, farmers cited the absence of disease and easy maintenance work, even if the plantations are far from home. In addition, the price was very favourable at the time of the survey: 15,000 IDR/kg[7] as against 18,000 IDR/kg only for cocoa and with more problems. The only drawback with rubber plantations is

[7]IDR: Indonesian rupiah, 1 € was equivalent to about 12,000 IDR in 2011.

the harvesting of rubber: it is a time-consuming process which requires a certain expertise and is partially dependent on the rains.

Regardless of the status of a protected forest, farmers continued to clear forest land and plant cash crops in 2011. Three types of crops were in competition in Aceh Tenggara: cocoa, rubber and oil palm. The farmers themselves suggested the following determinants:

- selling price of products;
- cost of establishing each crop;
- the difficulty of the work to maintain the plantation;
- level of attacks by pests and diseases;
- number of harvests per year which determines income regularity;
- knowledge that farmers have about the crop.

The survey did not observe any competition between cocoa and oil palm in the northern part of the district. The further we went into the hills, the younger were the cocoa plants and more they tended to be grown as a 'monoculture', with very little shade. Plantations thus created a 'pioneer mosaic' landscape with rubber plots and forests. Competition between cocoa and oil palm existed in the southern part of the district, near North Sumatra province, both in the valley and on the slopes (Fig. 16.7). Nevertheless, despite saying they will remove cocoa in the near future due to the pressure of insects, rodents and diseases, oil palm growers did solve the issue of competition by intercropping the two crops on 40 % of their plantation area. Diversification into oil palm took place mainly at the expense of candlenut, which was also affected by the two major determinants of diversification for perennial crops: declining prices of the product and the aging of the trees which reduces yields irreversibly and thus affects income.

## 16.3 Conclusion

Just like other regions of Indonesia, Aceh exhibits multiple diversification processes. These include diversification through agroforestry systems at the plot level —such plots in Indonesia are very old,—at the village level and at the landscape level. The latter are based more on monospecific plots and on the opening of new agricultural frontiers. Cocoa cultivation finds place in the two major systems, both as a new crop for diversification that is expanding rapidly, and a crop in decline—neglected or partially replaced by new perennial crops.

As a new diversification crop, cocoa inserted itself into an agroforestry system by partly replacing clove and coffee. It adapted best under the tall Areca palms. Since it is capable of establishing itself rapidly, it was used to open up new agricultural frontiers and for expanding areas under cultivation. To a lesser degree, cocoa can also replace paddies that are little irrigated, or not irrigated at all. A plot-level conversion can then take place. However, because of the marginal

nature of this form of diversification, we can safely affirm that farm- or village-level diversification is the most common.

Like other perennial crop, cocoa too is prone to a recession phase, at which time it is either neglected in the agroforestry system or is gradually replaced by rubber and oil palm. Here too, there can be partial abandonment or conversion to another crop at the plot level, thus leaving little room for diversification. However, due to the simultaneous expansion of cocoa cultivation in adjacent forest areas, we witness a diversification at the level of farms, landscapes and 'village terroirs'.

Despite differences in geographical, social and political situations between districts in the north and the south-east, we found a combination of major determinants of diversification. There is the quasi-structural ecological change, in the sense that after several years of expansion and growth, all perennial crops are weakened eventually by age and the arrival or adaptation of pests and diseases. This situation naturally encourages the adoption of a new crop. This is indeed one of the principles of the 'unfolding of a cycle'. We notice how diversification reflects the manner in which this works around villages: first clove, then coffee, and finally cocoa, with a new cycle emerging subsequently, that of oil palm and rubber.

We also saw a key determinant, 'price', which led farmers to expect good future income with a new diversification crop when the 'old' crop suffered from low prices for several years. We observed the attraction to an income that came in with greater regularity. In Aceh, this factor was the basis of the attraction, between 1980 and 2000, of cocoa over coffee or clove which are harvested but once a year. Even now, in the 2010s, the consistent regularity of palm bunch and rubber harvests attracts both Indonesian cocoa farmers and their African counterparts.

We also saw the key role of public policies and private plantations as disseminators of information and planting material, which are naturally essential to diversification.

Public policy, chronologically the first factor in Aceh, was affected by continued armed conflict for more than 30 years. This paradox is partly explained by attempts made by the then government to garner the goodwill of rural people, or at least turn them away from the rebels. A second 'public policy' paradox pertains to the antagonistic effect of the conflict, with the army ordering farmers not to go to their fields, which delayed cocoa diversification until the late 2000s.

Finally, as in Africa and Sulawesi, Aceh enters this quasi-universal transition phase in the late 2000s. The dynamics swing between:

- the decline of cocoa. This is both the cause and consequence of the start of diversification to oil palm and rubber. The agroforestry strategy gave no prior indication of this;
- the expansion of cocoa in the form of quasi-monoculture agricultural frontiers.

The issue of replanting, rehabilitation and intensification of existing old plantations resurfaced once again. It is an age-old problem that extension services and projects have been trying to solve for decades but without much success. This will be so as long as farmers have the opportunity to open up new agricultural frontiers. Several projects have been launched in Aceh following the tsunami, the most ambitious of

them being *Peka*. In 2011, relying greatly on the experience and success of the Mars company in Sulawesi, this project successfully drew the attention of farmers in Aceh to the concept of rehabilitation by grafting. However, as in the case of many rehabilitation projects, we can only hope for change rather than seek a demonstration, because past experience shows that the diversification process often takes precedence over those of rehabilitation and replanting. The subject is relevant today and will remain so for foreseeable future.

Meanwhile, the strategies of the expansion of agricultural frontiers and diversification into other perennial crops seem to be gaining in strength. This could ultimately prove unfortunate. However, considering the state of technology and policies, we can also conclude that this dual strategy of short-term specialization and opportunistic diversification is very effective, one of the best possible strategies for family farming in Aceh.

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