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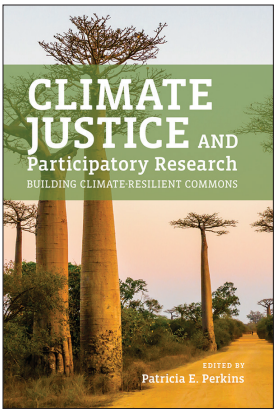

CLIMATE JUSTICE AND PARTICIPATORY RESEARCH: BUILDING CLIMATE-RESILIENT COMMONS

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The Oil Palm Sector in the Climate Crisis: Resilience and Social Justice in the Commune of Ngwéi (Littoral-Cameroon)

Guy Donald Abassombe, Mesmin Tchindjang, and Vadel Eneckdem Tsopgni

Introduction

Climate change is currently a central concern for both scientists and political decision-makers at the global level (Niang, 2009); it constitutes one of the many obstacles to human development (Brown & Crawford, 2008; Boko, 1988). The intrinsic injustice of global warming, which makes the poorest pay the consequences of the actions of the richest, is even more flagrant for peasants (Capocci et al., 2015; Development and Peace, 2015). This is because agriculture, which is one of the main levers of economic development, essentially depends on climatic conditions (Chanzy et al., 2015; Bélanger & Bootsma, 2004). Agriculture can be seen as both a victim of climate change, and also as one of its major causes (Baudouin, 2021). Deforestation for agriculture contributes to greenhouse gas (GHG) emissions, reduces habitat and biodiversity, and can reduce carbon sequestration, thus exacerbating climate change. On the other hand, climatic disturbances have a direct impact on agricultural production and yields (Boko et al., 2007; Mertz et al., 2009). This impact is particularly significant in developing countries where agriculture is largely

rain-fed and is the main source of employment and income for the majority of the population (Agossou et al., 2012; Delille, 2011; Enete & Onyekuru, 2011). From the home to the international scale, economic and social injustices and inequalities at all levels exacerbate these impacts, aggravating hunger and poverty in developing countries (Ramirez-Villegas & Thornton, 2015; Rawe & Deering, 2015). Cameroon is already affected by these manifestations of climate change, which are multiplying across the country's different agro-ecological zones (P. Amougou, 2016; J. Amougou, 2018; J. Amougou & Batha, 2014; J. Amougou et al., 2013; Tchindjang et al., 2017). The agricultural sector, which employs about 70 per cent of the economically active population and generates 80 per cent of the primary sector's contribution to the gross domestic product (GDP), is highly affected by climate change. Impacts on agricultural production erode the living conditions of farmers (Mamoudou, 2019; Djitie Kouatcho et al., 2019), despite their strategic actions in response.

The oil palm sector, which currently constitutes one of the strategic pillars of economic growth in Cameroon according to the nation's *Strategy Document for Growth and Employment* (Republique du Cameroun, 2009), is not spared from this reality. In the Commune of Ngwéi[1] and throughout the agricultural basins of the Littoral-Cameroon, the oil palm sector is already threatened by climate change, affecting both productivity and the living conditions of farmers. Faced with growing demand for land that fuels massive land grabbing (Sitou et al., 2014), combined with most farmers' limited access to agricultural inputs, smallholders are struggling to fit into the process of development linked to the expansion of palm groves. This situation makes the oil palm sector a sustainable development issue, especially in this area where oil palm provides 85 per cent of the local population's income.[2]

What are the forms of social injustice that characterize the oil palm sector, how does climate change affect this agricultural sector, and what alternatives exist for the development of a more climate-resilient palm sector in coastal Cameroon?

This chapter reports on our participatory research to investigate these questions, with the help of two hundred and ninety palm oil producers from twenty-nine villages in Ngwéi, where oil palm production has a long history stretching back hundreds of years.[3] Through interviews with the farmers, workshops to share knowledge about global warming and climate justice, and small-group discussions in each village, we explored the changes the farmers are experiencing, the challenges they face, and their comments about

what would help to improve their livelihood options. We also documented the farmers' own informal and strategic initiatives towards protecting their livelihoods in the face of climate change. We complement the information they shared by summarizing available weather statistics and documentary research on the impacts of climate change in coastal Cameroon, and on palm oil production and climate justice in central Africa more broadly. Our concluding reflections are based on the findings, demonstrated through our research with small farmers, that land insecurity and farmers' limited access to agricultural inputs accentuate the effects of climate change for oil palm farmers in Ngwéi.

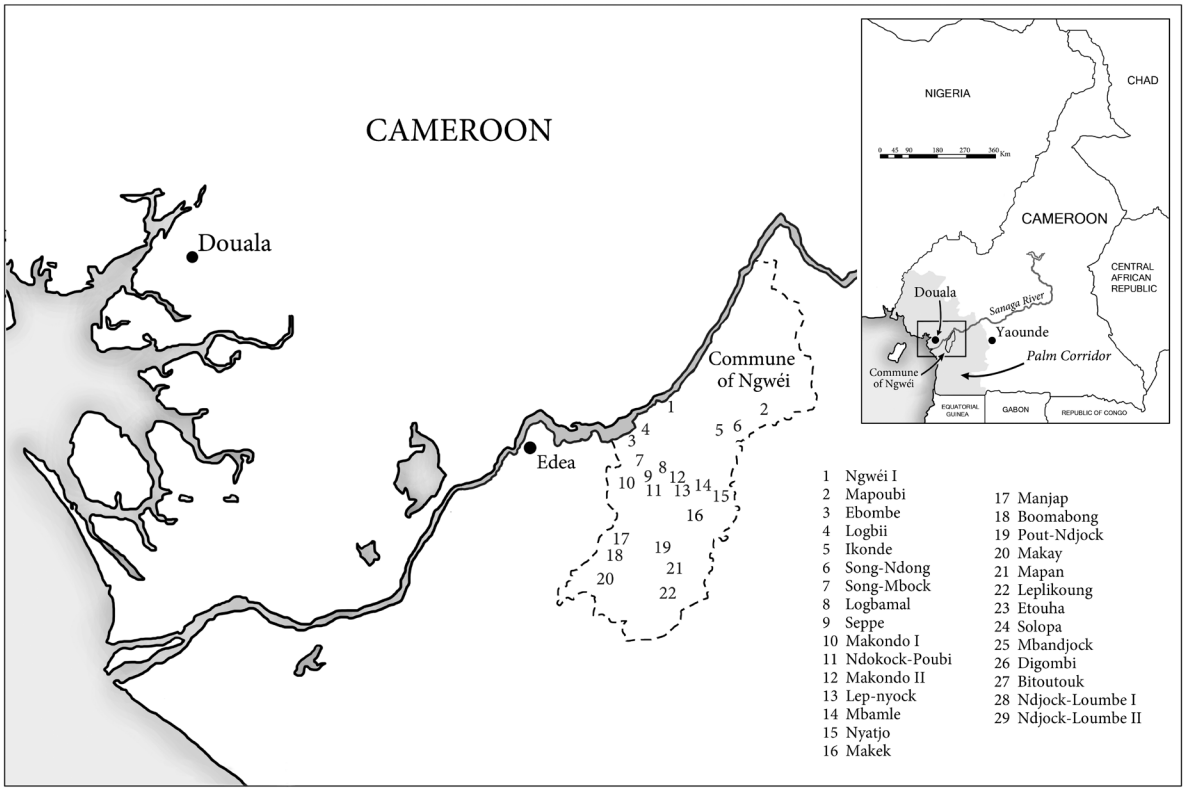
The chapter is organized as follows. Section two sets out the geographical context and methodology for our work. Survey and interview results on climate trends and impacts on small farmers are discussed in section three, along with related statistical information on rainfall and temperature. Section four explains how small farmers are adapting and changing their practices to cope with the impacts they are experiencing. Our reflections and conclusions make up section five.

Spatial Context and Methodological Approach

The Commune of Ngwéi is located in the oil palm cultivation corridor on the coastal strip of Cameroon (Map 4). It is situated at the gateway to the main outlet basins for palm oil production in Cameroon, notably 30 km from Edea and 90 km from Douala, the economic metropolis and industrial free zone of the country. This strategic position fuels strong expansion pressure within the territory. Located in the Littoral-Cameroon region, this commune covers an area of approximately 500 km² (PNDP, 2018).

Like most areas on the Cameroonian coast, the physical setting of the Commune of Ngwéi is favourable for oil palm cultivation. In terms of climatic conditions, there is fairly constant humidity and heat throughout the year. This zone has a humid, Equatorial Guinean-type climate characterized by four seasons: The short and long dry seasons extend respectively from November to January and from February to March. The short rainy season generally extends from April to June and the big one begins in July until August. The oil palm grows best in equatorial zones, which benefit from both high rainfall (at least 1800 mm per year, or 150 mm/month), and an average annual temperature of at least 26°C. Data on the monthly average trends of

Map 4
Cameroon—Commune of Ngwéi



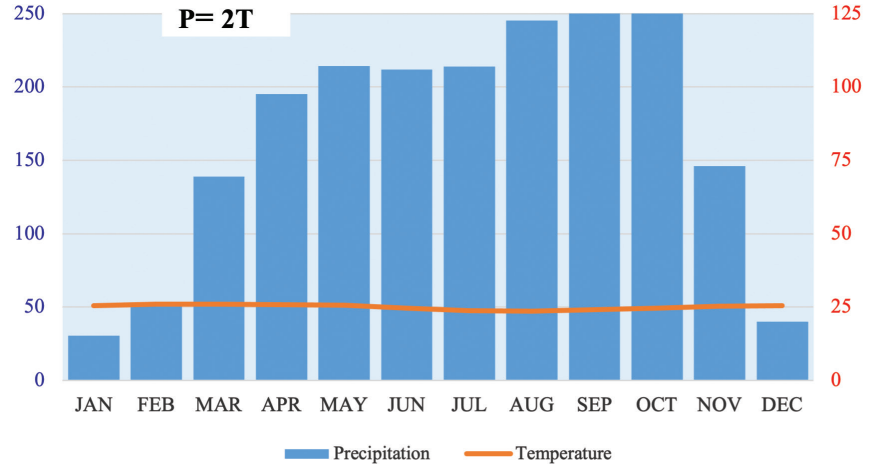


Fig. 4.1 Temperature and rainfall diagram of the Commune of Ngwéi, produced from the monthly averages over the period from 1981–2017. **Source**: Climate data from NASA (2021), Surface Meteorology and Solar Energy (SSE). Compiled by the first author.

precipitation and temperatures over the period from 1981–2017 show that the Commune of Ngwéi receives a large amount of rainfall (on average 2400 mm/year), with temperatures oscillating around 26°C (Figure 4.1).

Relatively flat land is best for oil palm cultivation (Jacquemard, 2011). The Commune of Ngwéi extends over a vast low plain with hills that decline in height farther to the south, which is dominated by river floodplains. Thus, the centre and the south of the Commune of Ngwéi, compared to the north, are more conducive to the cultivation of oil palm, which has expanded there. Map 4 shows the oil palm cultivation zone in southeastern Cameroon.

Methodology

To investigate how climate change is affecting the oil palm sector, what options palm producers have for risk reduction, and the social justice implications, we adopted a mixed methods approach blending weather and agricultural data analysis with participatory engagement with palm farmers to ask them about how climate-related impacts are affecting them and their livelihood strategies.

The background climate data used in this study was obtained from NASA, Surface Meteorology and Solar Energy (SSE) (NASA, 2021). These data cover the period from 1981–2017.[4] All the surveys carried out in Commune of Ngwéi took place from November 2019 to August 2021, as part of the first author's doctoral research.

Regarding the collection of socio-economic data, a survey questionnaire was administered to a targeted sample made up of two hundred and ninety households of oil palm producers, or ten households in each of the twenty-nine villages (Map 4). The selection of the households to be surveyed was made in 2019 as part of the implementation of a phase of the Oil Palm and Adaptive Landscape (OPAL) project in the commune,[5] a project in which we participated as investigators. The choice of producers to include was made on the basis of their age, by observation of physical conditions before confirmation of the age data, and the number of years spent in Ngwéi. Thus, producers under forty and having lived less than twenty years in the village were systematically excluded in order to focus on those with more farming experience in the area. The questionnaire focused on the characteristics of farmers and their farms, their logic and methods of access to land and agricultural inputs, their assessment of the impacts of climate change on production, and the resilience strategies they adopted. To obtain more detailed information, group interviews were organized in six villages with a total of 138 people, as well as semi-structured interviews with a sample of selected farmers who are strongly involved in oil palm growing and production.[6]

Results

The Exploitation of Oil Palm in the Commune of Ngwéi Is an Activity Strongly Marked by Inequalities of Access to Factors of Production

Depending on the size of the areas developed and how agricultural inputs are used, two main types of oil palm exploitation coexist in the Commune of Ngwéi. First is village exploitation, which is generally practiced on small areas ranging from 0.5 to 2 ha for the most part, using wild palm seed whose productivity depends essentially on the natural fertility of the soil. Its practitioners are commonly referred to as "smallholders," and are mostly Indigenous communities, plus a few farmers from neighbouring municipalities or other

regions of the country. The other type of exploitation is "elitist exploitation." This is generally carried out on larger areas, ranging from 5 to more than 20 ha per farmer, using improved seeds with high-yield potential, chemical fertilizers, and regular application of phytosanitary products such as pesticides.

The oil palm activity in this commune is developing in a context of land insecurity and difficulties of access to agricultural inputs, especially for small farmers.

Massive Land Grabs Are Fuelled by Weak Land Governance

In most rural areas of Cameroon, as is the case in Ngwéi, access to and management of land is essentially governed through a customary regime. This land management system advocates the control of all land by the Indigenous population, the land being considered as the collective. It is up to each village chief to delimit plots for cultivation in proportion to the number of neighbourhoods and families. However, in certain forest areas, the effective appropriation of a plot is based on the "axe right" according to which "the land belongs to the first clearer." Such a context leads to inevitable illegal occupations of agricultural land, which most often benefits elites.[7]

Based on field interviews with village chiefs, most of the elites, because of their strong political or financial influence reputed in the village, unfairly appropriated family land and sometimes even the village land reserve. They do not hesitate to exploit for their own benefit the flaws of the customary land tenure system, but also those of local land governance, in particular the absence of rigorous management and control mechanisms. The majority of producers in our study (42 per cent), consisting mainly of farmers who practice oil palm cultivation on small areas ranging from 2 to 5 ha, and about 28 per cent practice this activity on even smaller areas, less than or equal to 1 ha (Figure 4.2).

Only 28 per cent of producers operate relatively average areas ranging from 6 to 20 ha, and less than 2 per cent have areas of palm groves greater than 20 ha, the latter category being essentially held by the elites. Indeed, the elites represent only 19 per cent of the population of producers surveyed yet hold 56 per cent of the total area of palm groves. In asserting these differences related to illegal land acquisitions and possessions, farmers do not hesitate to denounce this trend. One of them stated:

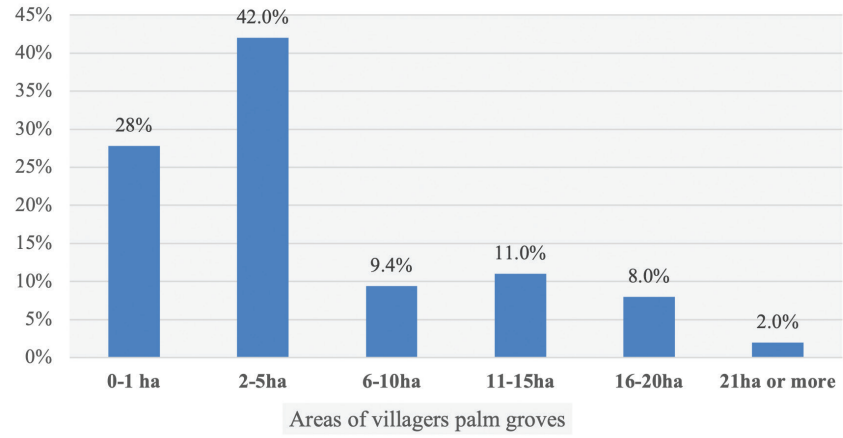


Fig. 4.2 Size of land areas farmed for oil palm in Ngwéi. **Source**: Processing of field survey data from 290 farmers in 29 villages.

> We small planters in Ngwéi are finding it increasingly difficult to extend our oil palm estates on our own land. Some local elites, because (they are) very rich and influential, allow themselves everything here, and this under the gaze of the local administrative authority. We are increasingly forced to fall back on forest regrowth to create our palm groves; even if the yields per hectare are not better on these types of vegetation, we have almost no choice. (A farmer during the Focus group in Seppe village, March 2020. Translation by the authors.)

Smallholders are finding it increasingly difficult to expand their agricultural estates to improve their incomes. This is associated with their degree of limited access to agricultural inputs.

Small Producers Have Limited Access to Agricultural Inputs

High yields in palm groves and increased income for producers are largely determined by the type of oil palm seeds used and the frequency of fertilizer and phytosanitary product use in the context of the operation. However, the surveys we carried out on the methods of palm-grove exploitation in Ngwéi reveal that the practices are 83 per cent traditional in relation to the types of seeds used, the frequency of fertilizer use, and the use of phytosanitary

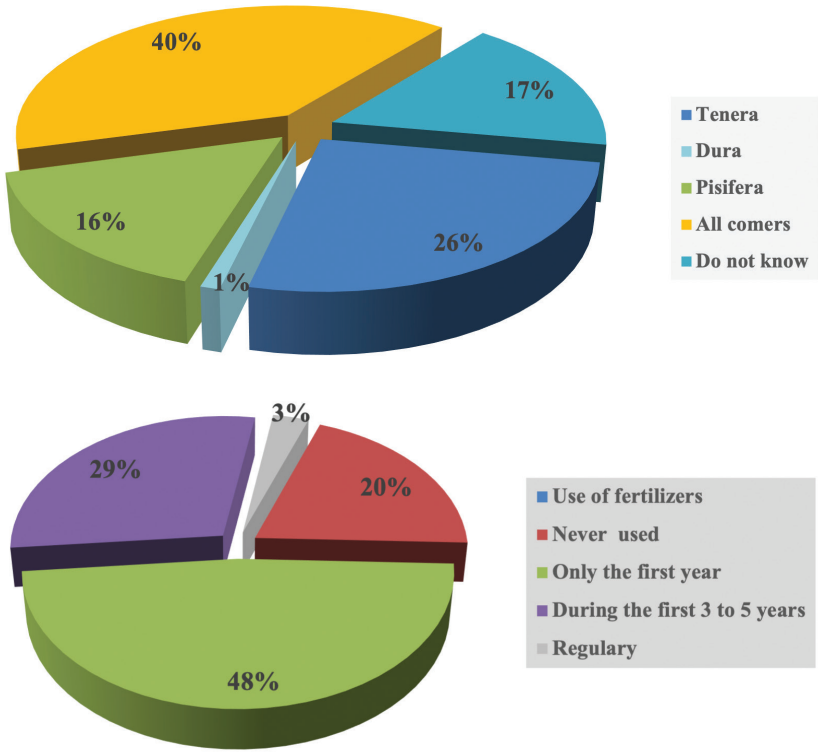


Fig. 4.3 (a) and **(b)** Type of palm seeds used and frequency chemical fertilizer use in oil palm cultivation in Ngwéi. **Source**: Processing of field survey data.

products. More than half of growers (57 per cent) use wild seed types with low yield potential (either Dura, Pisifera, or "run-of-the-mill" type[8]), and 17 per cent of growers are even unaware of the variety they are using in the field. Only 26 per cent use improved palm seed types with high yield potential, such as especially the Tenera type (Figure 4.3a). Similarly, barely 3 per cent of producers regularly use chemical fertilizers on their plantations. The rest of the producers use these fertilizers either just during the first year after the creation of the palm grove (48 per cent), or during the first three to five years (29 per cent), and 20 per cent of these farmers have never used chemical fertilizers at all (Figure 4.3b).

Two main reasons explain this: the first is the high cost of these inputs for the vast majority of small growers in view of their sometimes-derisory income. Most farmers do not have the necessary means to afford these agricultural inputs. The second reason is most farmers' ignorance about the role of agricultural inputs in terms of production. This is linked to the lack of information dissemination on the subject, in combination with the farmers' lack of access to education. Besides, the minority of peasants with means do not even know where to get farm supplies. To describe this reality, a planter explains:

> My son, almost everyone here uses wild seeds to create the palm plantations, even if the production is not always satisfactory. If the government could often help us with improved seeds that would allow us to have better production, it could increase our yields and income, because we do not have enough means for that. (A planter from Solopa village, December 2020)

Faced with these realities, most farmers in Ngwéi have to content themselves with the derisory income linked to the traditional exploitation of oil palm. The impact of climate change on production accentuates the decline in income.

Climate Change Significantly Impacts the Oil Palm Sector in the Commune of Ngwéi

Like almost all regions of Cameroon, the Commune of Ngwéi is deeply affected by the effects of climate change, and these have perceptible repercussions on the oil palm sector. We used statistics on temperature, precipitation, and their variability to trace the evolution of climate trends in Ngwéi over the thirty-six-year period from 1981 to 2017 (Figures 4.4, 4.5, and 4.6). In this analysis, we focused our gaze on the evolution of the two main climatic parameters (precipitation and temperature), because the growth and productivity of the oil palm depend essentially on them.

The evolution of rainfall on an annual scale (Figure 4.4) indicates a continuous decrease in the amount of rainfall over the study period. The annual average is 2,168 mm.

Of the thirty-six years (1981–2017) studied, seventeen years, representing 47 per cent of the series, recorded a cumulative rainfall below normal. Seven

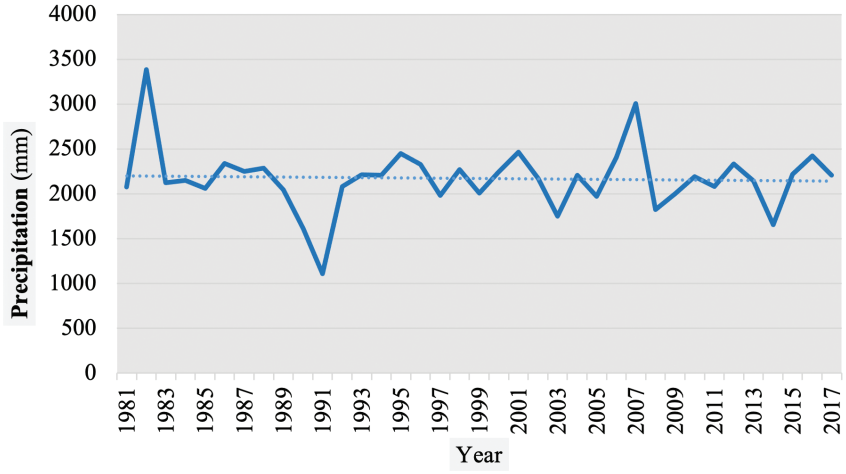


Fig. 4.4 Interannual variability and trend of precipitation between 1981 and 2017 in Ngwéi. **Source**: Processing of climate data from NASA (n.d.), Surface Meteorology and Solar Energy (SSE). Compiled by the first author.

of them, including 1990, 1991, 1997, 1999, 2003, 2005, 2008, and 2014, representing 22 per cent of the series, recorded cumulative rainfall strictly less than 2,000 mm. The year 1991, which was the driest with 1,104 mm, showed a deficit of 1,064 mm of rain compared to the annual average.

The analysis and interpretation of the standardized precipitation index in Ngwéi between 1981 and 2017 makes it possible to see alternations between surplus years and deficit years (Figure 4.5).

In fact, between 1981 and 2017, there were twenty surplus years, or 55.55 per cent of the series, with different humidity levels from one wet year to another. Extremely humid, highly humid, and moderately humid years are irregularly distributed and respectively represent two years (10 per cent), one year (5 per cent), and seventeen years (85 per cent). In terms of deficit years, there are sixteen years, or 44.44 per cent, with moisture deficits varying from year to year. These years reflect to varying degrees the decrease in cumulative rainfall or even drought episodes that occurred in Ngwéi between 1981 and 2017. Years with moderate, high, and extreme moisture deficits, respectively, were twelve years (75 per cent), three years (18.75 per cent), and one year (6.25 per cent). The sub-period going from 1989 to 1992 successively recorded

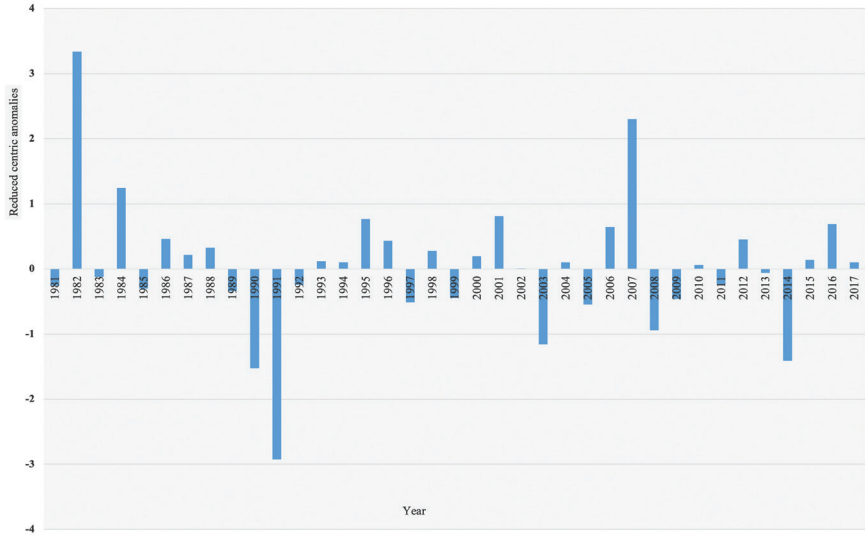


Fig. 4.5 Evolution of rainfall anomalies over the period 1981–2017 in Ngwéi. **Source**: Processing of climate data from NASA (n.d.), Surface Meteorology and Solar Energy (SSE). Compiled by the first author.

severe moisture deficits, with a peak of drought reached in 1991.[9] This climatic trend is like the recurrence of prolonged drought episodes that affected all of the coastal zone and the Cameroonian littoral between 1982 and 2010 (J. Amougou, 2018).

In addition, an inter-monthly analysis of the evolution of cumulative rainfall between 1981 and 2017 in Ngwéi shows two different trends compared to the climatological normal for rainfall (Figure 4.6).

Figure 4.6 shows that during the sub-period from 1981–2011, the Commune of Ngwéi experienced a regular increase in rainfall between seasons. The main rainy months (September and October) recorded a monthly cumulative rainfall of about 325 mm, or 25 mm more than the normal trend. On the other hand, the sub-period from 2011–2017 is marked by a considerable drop in rainfall between the seasons. These have, for example, dropped in the high season (September and October), going from 325 mm/month on average to around 230 mm/month, in particular a recorded rainfall deficit of 95 mm/month, i.e., 29 per cent lower than the 1981–2011 sub-period. This

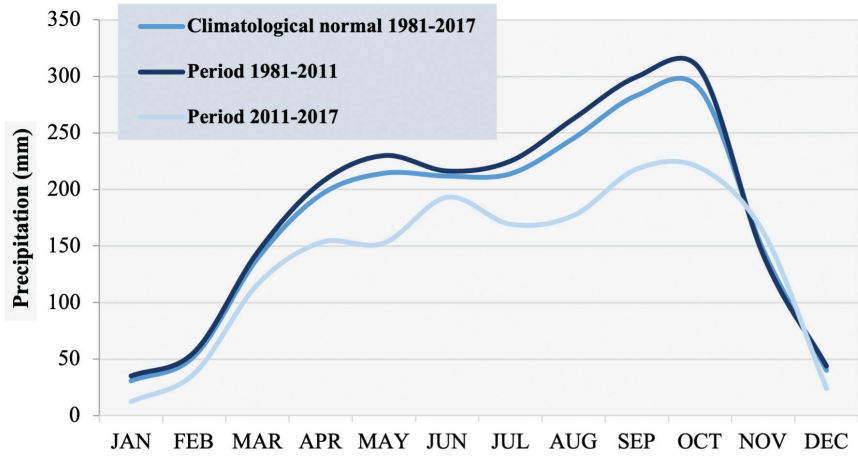


Fig. 4.6 Inter-monthly variability of precipitation compared to the climatological normal over the period 1981–2017 in Ngwéi. **Source**: Processing of climate data from NASA (n.d.), Surface Meteorology and Solar Energy (SSE). Compiled by the first author.

downward trend is in line with the findings of the majority of producers (77 per cent) in Ngwéi who perceived a general drop in rainfall for seven to ten years.

Conversely, the inter-monthly analysis of the evolution of temperatures over the same study period at Ngwéi reveals a considerable increase in temperatures compared to normal (Figure 4.7).

By separating the study period into two sub-periods, we can see that compared to the 2011 to 2017 sub-period, the hottest months in Ngwéi (December, January, February) all record a monthly temperature greater than or equal to 26°C. However, these months had never reached 26°C during the previous sub-period (1981–2011). This change in temperature probably reflects the manifestation of global warming of the climate and the establishment of a hot microclimate in Ngwéi.

The variability of these climatic conditions directly affects the production of oil palm and has a variable impact on the living conditions of producers.

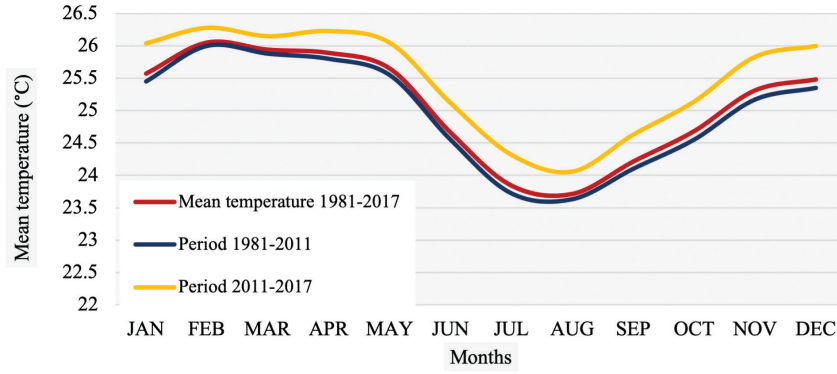


Fig. 4.7 Inter-monthly temperature variability compared to the climatological normal over the period 1981–2017 in Ngwéi. **Source**: Processing of climate data from NASA (n.d.), Surface Meteorology and Solar Energy (SSE). Compiled by the first author.

Impacts of Climatic Disturbances on Oil Palm Production Have Repercussions on the Lives of Producers in Ngwéi

At different levels of growth, disturbances linked to the variability of climatic conditions in Ngwéi (intense rains, intense and prolonged drought, recurrence of high winds, etc.) have perceptible effects on oil palm production. Nine impact indicators linked to three types of climatic disturbances are clearly perceived and identified by producers (Table 4.1).

Faced with the recurrence of episodes of intense drought during the year, farmers critically note, for example, the drying out and loss of leaves of young plants in the nursery, the lengthening of the growth period of young plants in the nursery and the delayed ripening of nut bunches. In addition to the drying up of young plants caused by the recurrence of episodes of intense drought, producers are increasingly victims of the devastation caused by locust invasions such as flies (*Diptera*), small snails (*Helix aspersa*), and stinking locusts (*Zonocerus variegatus*). These find refuge in nurseries and cause deterioration of the leaves and often the loss of many young plants in the nursery (Figure 4.8 a, b, and c).

Table 4.1 Impacts of the main climatic disturbances on oil palm production.

Climatic Disturbances	Effects on Oil Palm Production
Heavy rain/storms	- Loss of young plants due to invasions of small snails that find refuge on the leaves - Early and mass ripening of nut bunches and low yields - Seasonal upheaval in the ripening of palm nut bunches
High winds	- Turnover and destruction of young palm seedlings in nurseries or plantations - Delayed inflorescence of oilseed bunches
Intense and prolonged dryness	- Drying and loss of leaves of young plants in the nursery - Extension of the growth time of plants in the nursery - Loss of plants in the nursery due to locust attacks (flies, locusts, caterpillars) - Delayed ripening of nuts

Source: Field surveys.

In addition, the magnitude of the impacts caused by these climatic disturbances in Ngwéi is not the same from one producer to another (Figure 4.9), likely reflecting the variation in the level of vulnerability of producers.

The majority of producers (43.4 per cent) believe that their production and their activities are strongly affected by climatic disturbances, and 9.4 per cent even report a very strong effect. This trend mainly reflects the high vulnerability of smallholders in a sector where most practices (83 per cent) are traditional, which is one of the main causes of unsatisfactory yields. A handful of producers (13.2 per cent) believe that their production is somewhat affected by climate change, and just 3.8 per cent believe that they are only very slightly affected.

In addition, the producers report perceiving many social repercussions at the scale of the related to these impacts of climate change on production (Figure 4.10).

The majority of farmers surveyed (36 per cent) believe that the impacts of climatic disturbances on oil palm production contribute to the drop in their income, due to the drop in productivity that these impacts generate. A significant portion of the producers surveyed (26 per cent) believe that this climate dynamic exacerbates famine within the commune, and 21 per cent

Fig. 4.8 (a) and **(b)** Plants drying up in the nursery in a prolonged drought situation, and **(c)** degradation of the leaves of young plants in the nursery by insects. **Photo Credit**: G.D. Abassombe, February 2021.

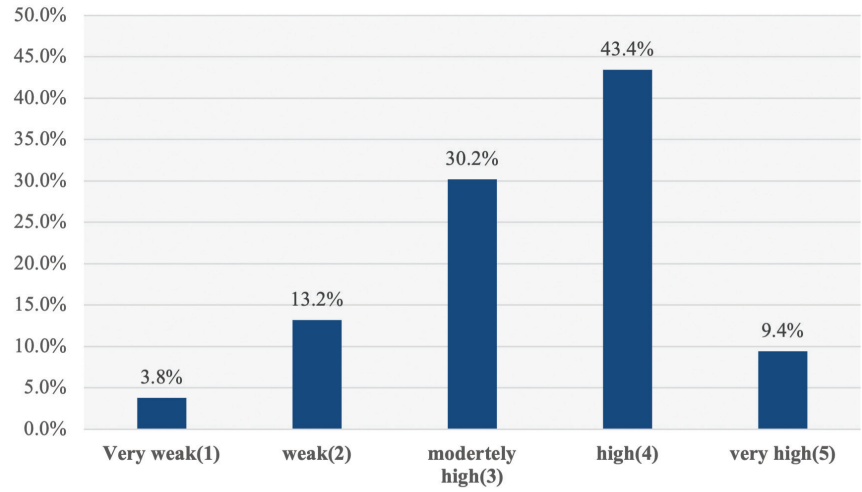


Fig. 4.9 Frequency of farmers' assessments of the level of severity of climate change on palm production in Ngwéi. **Source:** Processing and analysis of field survey data.

of producers even establish the link between these changes and the decline in local productive capacities. Indeed, like oil palm, food crops associated with palm groves are not spared the effects of climate variability. However, these crops are the main source of food for local communities and also an important source of food for neighbouring towns. A portion of the producers surveyed (12 per cent) believe that this drop in yields has a direct impact on their income and accentuates their impoverishment. These induced effects necessarily reflect the strong dependence of Ngwéi farmers on the exploitation of oil palm, especially in an area where this activity is the main source of income for local communities. Most of the peasants interviewed are finding it increasingly difficult to live essentially solely on income linked to the exploitation of palm groves.

To limit the effects of these impacts within their abilities to control their farming practices, the oil palm producers spontaneously and variably adopt a number of strategies.

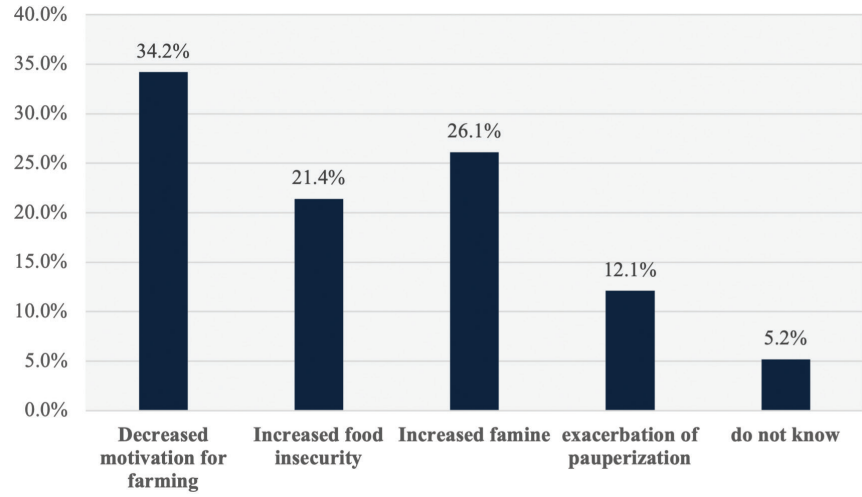


Fig. 4.10 Repercussions of the effects of climatic disturbances on the living conditions of producers/farmers in Ngwéi. **Source**: Processing and analysis of field survey data.

Adaptation Strategies Developed by Oil Palm Producers

Oil palm planters described nine types of strategic actions they have developed with the goal of minimizing the repercussions linked to climatic disturbances (Figure 4.11).

The temporary interplanting of food crops within palm groves is the first form of adaptation of oil producers to the effects of climatic disturbances in the Commune of Ngwéi because it represents 31 per cent of the sample surveyed. This high percentage surely reflects the particularly accessible nature and good mastery of this agricultural technique, no doubt because, basically, it has been endogenous cultural know-how for several decades. Currently in the Commune of Ngwéi, most planters are adopting this practice, to make their developed plots more profitable in order to compensate for the low income from the exploitation of the palm groves. A village chief involved in oil palm exploitation for more than thirty years makes revelations in this sense:

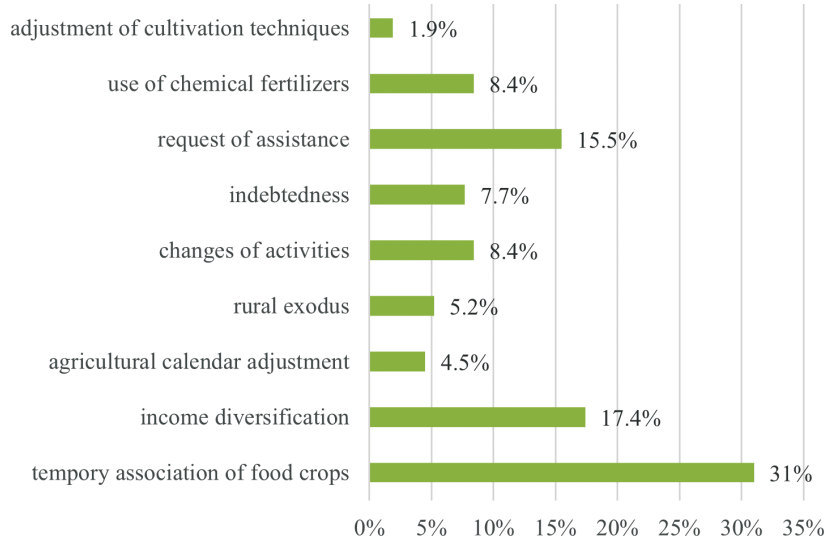


Fig. 4.11 Forms of adaptation of producers to the climate in Ngwéi. **Source**: Processing and analysis of field survey data.

> Before, and surely for personal reasons, few producers planted food crops in their palm groves. Those who did this only planted plantain during the first year.… Palm oil monoculture was dominant here, especially in view of the financial security it provided. I, who am speaking to you, preferred to plant my food crop plots separately, outside the palm groves. But for more than a decade, with the decline in yields from palm groves, many planters can no longer be satisfied with the income related to their production alone. People are increasingly intercropping at least for the first three years, and several agricultural speculations are now associated with both palm groves. Above all, this allows you to have a little money to strengthen the purchase of agricultural inputs. (Boomabong village chief, January 2021)

The other form of adaptation of oil palm operators is the diversification of sources of income, adopted by 17.4 per cent of the sample of producers surveyed. The decline in yields of palm groves exacerbated by the impacts of

climatic disturbances and their induced effects on farmers' incomes and living conditions feeds the need to develop other income-generating activities in parallel. Based on information collected from certain operators particularly affected by these changes, the diversification of economic activities aims to compensate for the almost derisory income from the current exploitation of palm groves. However, the diversification of income sources remains ineffective because it is unsatisfactory for most of the producers surveyed. The latter believe that the losses linked to the impacts of climate variations are enormous and the income from the diversification of economic activities is not always able to compensate for the drop in income linked to the exploitation of palm groves. A planter in distress recounts his situation:

> For nearly ten years, I have been operating a palm grove with an area of three hectares and at the same time, I extract and I also market palm wine. The income from these two activities made it easy to meet the needs of my small family. But in recent years, the observed decline in income related to the operation of my palm grove has considerably limited my ability to meet these needs. The situation even forces me to consider other sources of income to get by (a farmer from Logbii village, January 2021).

The use of foliar fertilizers and phytosanitary products is another form of adaptation by producers. It is practiced by 8.4 per cent of the sample of producers surveyed. Faced with the impacts of climatic disturbances, and to compensate for the lower yields they cause, planters with decent incomes generally resort to foliar fertilizers and insecticides (Figure 4.12 a and b).

A notable of the Solopa village clarifies these uses by brandishing these different products:

> Here are the products we use to fight against the damage caused by locust invasions in dry seasons on our nurseries. For a one litre bottle of this product, an average of 150 L of water must be used, i.e., ten sprayers. The treatment is done after one month. Apart from insecticide treatment, foliar fertilizers are also combined to restore vigour and colour to the foliage of plants that have been affected by drought or intense heat or that have been attacked by insects. It is therefore a

Fig. 4.12 Types of **(a)** foliar fertilizers and **(b)** insecticides used by farmers to fight against the attacks of locust plagues exacerbated by climate change. **Photo Credit:** G.D. Abassombe, February 2021.

> treatment that is both preventive and curative. (notable person from Solopa village, January 2021)

Following these statements, one of the producers present at the discussion session took the floor with a look of astonishment and exclaimed:

> I am very surprised to see that some producers have solutions to fight against these insect pests. I have never heard of these products. Obviously, I would be very surprised if such information reached us peasants, as usual, it is limited to the chieftaincy and among certain elites. Even if we don't necessarily have the means to buy it, we must at least be informed, you never know. (A beekeeper from Solopa village, January 2021)

However, and as mentioned above, these strategies, although diverse, remain insufficient, in view of numerous testimonies identified and observations

made on the repercussions of the impacts of climate change on the living conditions of producer communities in the Commune of Ngwéi. More appropriate social compensation mechanisms are needed for this purpose.

Moreover, in response to the upheaval in annual rainfall patterns, some farmers opt to adjust the planting period for palm trees. This measure practiced by a minority of producers (4.5 per cent) consists of shifting the dates of the start of planting from those of the start of the rains. In a situation of declining yields and incomes exacerbated by climatic disturbances, some farmers (7.7 per cent) opt for debt, and others (15.5 per cent) desperately seek public assistance, which generally does not help them. This uncomfortable situation leads some producers to convert completely to other sectors of activity that they consider more profitable and for others to consider migrating to the city in search of better living, as is the case for 8.4 per cent and 5.2 per cent of operators surveyed.

However, and as mentioned above, these strategies, although diverse, remain ineffective, in view of numerous testimonies identified and observations made on the repercussions of the impacts of climate change on the living conditions of producer communities in the Commune of Ngwéi.

Discussion and Perspectives

The agricultural production area of Ngwéi, like other similar areas on the Cameroonian coast, is considerably affected by climatic disturbances, and these have perceptible effects on the production of oil palm. These can be summarized as essentially a general decrease in cumulative rainfall and increase in temperatures, marked by the recurrence of episodes of intense drought throughout the year. Fomekong and Ngono (2011), analyzing the effects of climate change on agricultural production and on the population in Cameroon, point to a similar trend in climate dynamics in the increasingly unstable rainfall across the agricultural basins of the different agro-ecological zones. By analyzing the impact of climate change on the agricultural sector in Côte d'Ivoire, Gbossou (2020) also presents the trend of climate change impacts. Based on analysis of climate data (temperature and precipitation between 1961 and 2014), he notes an increase in average monthly temperatures (maximum and minimum), respectively of 1.5°C and 0.5°C, and a falling precipitation trend of nearly 20 per cent since 1965.

The recurrence of these climatic fluctuations in Ngwéi is largely responsible for the decline in yields of the production of palm nut bunches and the rate of palm oil extraction decried by farmers. This aggravates the unfavourable living conditions in which the vast majority of peasants live. P. Amougou's (2016) analysis of the impact of climate change on the oil palm agricultural sector in Cameroon even evokes a disaster scenario. He notes that the peasants of the agricultural production basins of the Littoral, Southwest, and West Cameroon find themselves overwhelmed by recent events in view of the manifest decline in productivity. This trend has also been highlighted since as early as 1995 by Yao et al. (1995), who analyze the evolution of the palm oil extraction rate under conditions of climate change in the Northeast of Ivory Coast. These studies indicate that oil palm production is affected by climatic fluctuations, in particular water stress, which affects growth, yields, and consequently the quantities of palm oil extracted, implying a drop in producer income.

However, the extent of these impacts on oil palm yields varies from one producer to another, according to their level of access to arable land and especially to agricultural inputs (seeds with high yield potential, chemical and phytosanitary fertilizers, etc.). The socio-political or administrative status and purchasing power of farmers largely determine these differences. In his analysis of climate change in the rice sector in Gagnoa in Ivory Coast, Gbossou (2020) arrives at a similar result by pointing out that this agricultural sector is very affected by climate change because of several factors that lead to precarious socio-economic conditions. The analysis of CARE and Food Tank (2015) on the culture of equality for fair and sustainable agricultural systems in the context of climate change also reflects this reality. It notes and demonstrates that inequalities determine who has access to food and the resources to grow and buy it. Hunger and poverty are not accidents, they are the result of economic and social injustices, and this reality is even more true for smallholder farmers. Similarly, and always with the aim of highlighting the link between socio-economic inequalities and the differentiated effects of climate change, Development and Peace (2015), through its analysis of peasant agriculture at the heart of climate justice, highlights the same reality. This analysis reveals that the areas worked by peasant farmers rarely exceed two hectares, making peasant agriculture one of the activities most affected by climate change.

In such conditions of injustice and social and economic inequalities between farmers, the administrative authorities have a sovereign duty to reduce

these inequalities according to the principle of difference (Rawls, 1971). This implies maximizing the primary goods (income and wealth, and access to land) of the weakest. This measure is not aimed principally at alleviating handicaps on an equitable basis, but instead at improving the long-term expectations of the most disadvantaged. In reference to oil palm cultivation in Ngwéi, these provisions should above all promote more rigorous and assured governance that can promote equitable management of arable land, thus stimulating the development of a more productive agricultural system by facilitating access and distribution of high-yielding palm seeds, fertilizers, and phytosanitary products. Raising awareness about the challenges of climate change, and strengthening the technical capacities of small producers for more productive and economically resilient farming practices, must be added to these measures.

Conclusion

By emphasizing the inequalities of access to factors of production among oil palm producers, this study aimed to characterize the impacts of climate change on the oil palm sector and highlight the strategic actions developed by producers in Ngwéi. The recurrence of heavy rains and episodes of intense and prolonged drought, added to high winds, affect the oil palm variably and at different stages of growth. Because of most small producers' difficulties of access to production resources, the decline in agricultural yields and their incomes caused by climatic fluctuations exacerbate poverty, especially among small producers. In this context, they have spontaneously developed several strategic actions, including the extension of the areas developed for some, inter-planting food crops and fruit trees in palm groves, and the diversification of sources of income for others. Thus, the development of a more climate-resilient sector in this agricultural production area must necessarily go through the implementation of an agricultural system that reconciles these factors: More rigorous and fair land governance, awareness-raising and training of producers, and facilitating access to and dissemination of agricultural inputs for all. Echoing the calls of local farmers, we conclude that this is the *sine qua non* condition for improving peasant resilience and advancing climate justice in this agricultural sector in Ngwéi, and by extension in Cameroon in general.

NOTES

1 In Cameroon, a "commune" is the smallest territorial unit in the administrative hierarchy—a decentralized territorial community.

2 Increased global demand for palm oil as a biofuel and substitute for petrochemicals in some uses is helping to drive the global expansion in palm oil production, especially in Southeast Asia and Latin America (Paterson & Lima, 2017; Pye, 2010; Ordway et al., 2019). In Cameroon, where the oil palm is native and many parts of the tree (not just oil-bearing nuts) have local uses, oil palm products are destined for domestic consumption (Ayompe et al., 2021). We focus here on climate justice implications from the viewpoint of local small farmers.

3 Historically, the exploitation of oil palm in the Commune of Ngwéi and in most coastal localities is a socio-cultural and colonial heritage. Oil palm has been growing there naturally for a long time (Carrere, 2013; Ndjogui et al., 2014), and was exploited for family subsistence, as the main source of dietary fats, until the colonial period. In plots intended mainly for food production, the density of naturally growing palm trees is maintained; these are spared during clearing and burning and exploited for twenty-five to thirty years. Cultivated oil palm plantations began on the Cameroonian coast in 1907 during the German protectorate and continued in 1910 with the creation in Edea of industrial plantations by the company Ferme-Suisse (Elong, 2003; Ndjogui et al., 2014).

4 Data choices were linked to the incomplete nature of the daily data series in the study area, due to the condition and quality of the measuring instruments used in the collection stations. The processing of these data consisted on the one hand in calculating the arithmetic mean over the study period (thirty-six years). This served as a reference for the assessment of the various upward or downward trends in rainfall, with a view to characterizing their evolution in Ngwéi. Dispersion parameters such as standard deviation and coefficient of variation were determined. In a complementary way, the standardized rainfall index was determined to assess the indicators of interannual rainfall variation over the study period.

5 The Oil Palm Adaptive Landscapes (OPAL) project uses natural and social sciences to create role plays that illustrate the existing realities of oil palm landscapes. Using these games, the team aims to explore alternative trajectories for oil palm with stakeholders and decision-makers in Indonesia, Cameroon, and Colombia, in order to chart the course towards a more sustainable future. Further information is on the project website: http://www.opal-project.org/.

6 The statistical series of climatic data on the study area as well as the survey data from the questionnaires were processed using Microsoft Excel 2013 software. The database of geographical coordinates of the National Institute of Cartography (INC) made possible cartographic processing using ArcGIS 10.2 software.

7 This often applies to people from the locality, who are senior executives in the public or private sector, permanently residing in the city or abroad and receiving high and regular incomes, and who have a real social, political, and economic influence.

8 This phrase is used to describe wild oil palm seeds of various types that are planted at the same time in the context of oil exploitation. These are obtained by selecting nuts from the production of an old palm grove, from which seedling nurseries are created.

9 Nicholson et al. (1988) cite a method for determining the standardized precipitation index (SPI). Better than the annual variability of precipitation alone, the SPI makes it possible to monitor the evolution of rainfall fluctuations, in particular the levels of drought severity. The SPI is one of the most recommended methods for analyzing climate variability. It is calculated from the mean of the data series and its standard deviation. Our calculations and use of the SPI are reported elsewhere.

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