

Spatio-Temporal Dynamics of Small Scale Coffee and Oil Palm Plantations in the Menchum South, North West Region of Cameroon

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Abstract: The establishment of agro-plantations in different parts of the world has been greeted as one of activities towards socio-economic development. Whilst this has been received with fanfare by the private and public sector, the dynamics of agro-plantations should not be underestimated. This study aims to investigate the spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South. The study stems from the fact that coffee and oil palm present differential dynamics in terms of spatial growth and surface area occupied over time. In essence, the spatio-temporal dynamism of small scale coffee and oil palm plantations is controlled by certain parameters. This study employed a survey research design that was corroborated with the use of primary and secondary sources of data collection techniques. Through primary sources of data collection, a systematic field observation and administration of 142 copies of questionnaires were used in the 8 sampled villages within the Menchum South. The copies of questionnaire were distributed specifically to coffee and oil palm plantation owners using a purposive sampling technique. Findings revealed a significant change in the spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South. The results of map to map analysis indicate 11.57km² declined in the surface area under coffee plantation between 1994 and 2024 while oil palm plantation experienced an increase of 22.23km² between 1994 and 2024. The results further revealed that the search for suitable climatic conditions (6.3%), the availability of cheap labour (12.0%) and access to financial credibility (9.9%), influence of topography and soil (19.7%) and the desire to invest (25.4%) accounted for the dynamic parameters of the plantations. The study recommends a shift from small to large scale plantations, adequate funding and provision of resources to plantationists by government agencies and NGOs and modernization of agro-plantation activities to ensure sustainable oil palm productivity.

Keywords: Dynamics, Oil Palm, Plantation, Small Scale, Spatio-Temporal.

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1. Introduction

For several decades, coffee and oil palm production have dominated the global markets due to the increasing demand from the growing population. Coffee is important cash crop across the world and a major source of export earnings. It is second only to crude oil as the most important internationally traded commodity in monetary value (Danida, 2012). In spite of high export earnings from coffee globally, coffee produced in most African countries fetch low prices compared to coffee from other continents due to relatively lower quality coffee (Chege, 2012). As a result, most coffee farmers get lower incomes from coffee sales, which make very little difference in helping them out of poverty. Coffee is also the world's widely traded tropical agricultural commodity accounting for exports worth estimated US\$ 15.4 billion in 2009/2010 when 93.4 bags were shipped (ICO, 2013). Coffee production by small scale farmers support about 25 million people around the world (Waston and Achineli, 2008). Coffee production has been on a declining trend since 1987/88. The industry now contributes about 3.2% of Kenya's foreign exchange earnings, a drop from the 40% contribution in the late 1980s, (Karanja and Nyoro, 2002). Consequently, the coffee growing regions are now experiencing escalating poverty and insecurity. The declining trend in coffee production and establishment of agro-plantations cut across many countries in Central Africa.

The trend in oil palm production has been positive and increasing given the world's demand and increase prices. Palm oil has become the world's leading vegetable oil in terms of consumption and production with 45.3 million tons (t) produced worldwide in 2009. The biggest producer, with a 47.6% share in production in 2009 was Indonesia, followed by Malaysia (38.8%) and Thailand (2.9%). Global production of oil palms have been increasing tremendously in the last decade with average annual growth rates of 9.7% between 1998 and 2008 (Borras & Franco, 2011). Oil Palm accounts for a third of the total 130 million tons per year of vegetable oil globally traded per year (Colchester, 2011). Total global production of oil palm is estimated at over 45 million tons, with Indonesia and Malaysia as the major world producers and exporters. The area planted with oil palm in Thailand has been increasing constantly, with an average annual growth rate of 11% from 1981 to 2000 and 9% from 2001 to 2010. This is very much in line with the average annual growth rate of 9.7% between 1998 and 2008. In Thailand, more than 120,000 farmers are involved in oil palm cultivation, mostly on small to medium sized farms. Oil palm expansion has come under intense scrutiny in recent years owing to its role in tropical deforestation (Carlson *et al.*, 2012; Henders *et al.*, 2015; Gaveau *et al.*, 2016). Although concentrated in South East Asia, oil palm production expanded by 1.2 million hectares (ha) in Sub-Saharan Africa between 1990 and 2017, with expansion accelerating in several heavily forested countries since 2000 (FAO, 2017; Ordway *et al.*, 2017).

Large tracts of unconverted land, an abundance of rural labor and growing domestic demands for palm oil signal potential production growth in the region (Feintrenie, 2014; Rival and Levang, 2014; Byerlee *et al.*, 2017). Ten palm oil producing countries in Africa, including Cameroon, are engaged in the Africa Palm Oil Initiative (APOI) under the Tropical Forest Alliance 2020 (TFA, 2017). Over the past few years, the global demand for oil palm has significantly increased and has gained a significant market share

against other less accessible and more expensive vegetable oils. In the Cameroonian context, the 1994 New Agricultural Policy of MINADER states that there is a need for increased investment in agro-industry through privatization of existing public institutions and the creation of new agro-industrial plantations, including oil palm. This has remained a great push towards the establishment of small scale agro-plantations in different parts of the country including Menchum South of the North West Region.

2. The Problem

It is undoubtedly clear that small scale coffee and oil palm plantations remain essential livelihood surviving activities to the population of the Menchum South. Whilst the demand for oil palm by the growing population has been increasing, small scale coffee and oil palm plantationists have equally shifted their dynamic pattern over time. Small coffee plantations have been replaced by oil palm whose demand increases daily. Consequently, the commercialization purpose of oil palm tends to increase in the area under cultivation given the ready demand for its products over time. Coffee plantations in this area appear to witness a declining trend so much so that most of the land that were previously under coffee cultivation have now been replaced by oil palm plantations. The dynamics of small scale coffee and oil palm plantations is explained by plethora of drivers. A combination of factors explains the persistent shortages of oil palm in the local markets despite increasing number of oil palm producers in the Menchum South. It has been established that since 1990s, price of coffee in the market has dropped which however appears to discourage most farmers to carry out or expand their coffee fields. The shortage of oil palms in the urban and semi urban markets of Bamenda, Wum, Bali and Bafut is accelerated by the increasing demand of oil palms by neighboring Nigeria which is an issue of high consideration.

3. Choice and Justification of the Study Area

Menchum South is located in Menchum Division and covering two sub divisions being Wum Central and Menchum Valley. Menchum South lies between latitudes $5^{\circ} 25'$ and $6^{\circ} 15'N$ and longitude $9^{\circ} 7'$ and $10^{\circ} 21'E$. It is bordered by three Divisions in the North West Region of Cameroon. Menchum South is bordered in the North by Menchum North, North East by Boyo Division, to the West by Federal Republic of Nigeria and to the South by Mezam Division (Figure 1). Menchum South lies in the Menchum River Basin which has approximate basin surface area of $2116km^2$ (Wum Council Report, 2018).

The choice and justification of the study area holds from the fact Menchum South in Menchum Division is one of the oil producing areas of Cameroon. Though the oil produced in this zone is widely consumed especially by Nigeria and most parts of the North West Region of Cameroon, little is known about the oil produced in this area. The local population seems to suffer from artificial oil palm scarcity while neighbouring Nigeria makes use of the oil which is constantly being transported to meet the growing demand. Besides, the demand of oil palm today is higher than coffee since most households need oil palm for daily cooking. This justifies the need for the spatio-temporal expansion of oil palm plantations in the area. The climatic conditions, soil, topography and drainage all together provide favourable conditions for the establishment of oil palm plantations in the Menchum South.

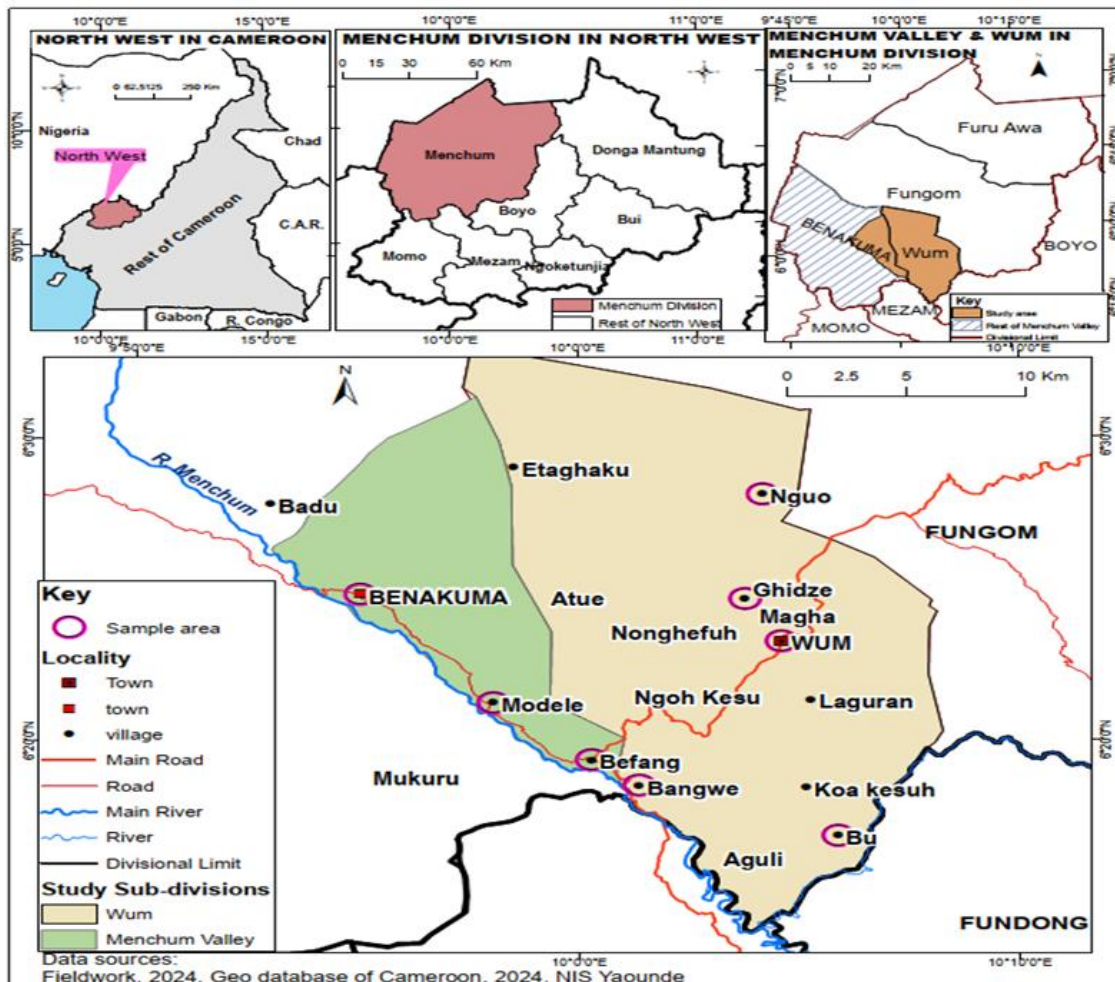


Figure 1: Location of Menchum South in the North West Region of Cameroon

Source: Geo database of Cameroon (2023)

This agro-plantation zone is located within the humid tropics with eight months of rainfall and four months of dry season with average yearly rainfall of about 2000mm. The area equally presents gentle sloping topography with fertile alluvial soils with great potentials to promote the establishment of coffee and oil palm plantations. It is established that both the physical and human induced parameters work together to justify the spatio-temporal dynamics of small scale coffee and oil palm plantation within the Menchum South.

4. Materials and Methods

This study was conducted a broad survey research design using both primary and secondary techniques to collect data or information from the field. An extensive field observation and questionnaire facilitated the gathering of information related to the spatio-temporal expansion of coffee and oil palm plantation. Field observation was carried out in the two sub divisions of the Menchum South covering areas such as Aghem, Bu, Bangwe, Ngoh-Kesu, Befang, Modele, Benakuma and Benade. The essence was to obtain first-hand information on the spatial location of small scale coffee and oil palm plantation and to measure the average plantation size under specific plantation. Also, field observation enabled the administration of copies of questionnaire to collect information from plantationists on the changes on their farm size,

productivity trend, changes from coffee to oil palm, their preference for setting oil palm over coffee plantations and the choice of locating small scale plantation on the different topographic settings.

This study made use of 142 copies of questionnaires to sample the plantationists' views on the spatio-temporal dynamics of small scale coffee and oil palm plantations over time. The copies of questionnaire were distributed using a purposive sampling technique. The questionnaire addresses issues related to the reasons for the changes of small scale coffee and oil palm plantations, in terms of size of the plantation, expansion, shift from coffee to oil palm and the demand of the products. Data on spatio-temporal changes of small scale coffee and oil palm plantations were matched by Landsat Images between 1994 and 2024. The 1994 date base was used as the period local farmers developed interest to shift from coffee to oil palm production given the global market fall in prices of coffee. In much the same way, the 2024 images was used to show the current limit of coffee and oil palm plantationists precipitated by the combine drivers to explain the dynamics of these small scale agro-plantations in the Menchum South. Therefore, the Landsat images provided sufficient information on the spatio-temporal changes in terms of surface area under coffee and oil palm plantation in the Menchum South.

The data collected thereof were analysed using the Chi-Square (X^2) statistical test to compare the dynamics of small scale coffee and oil palm plantations between 1994 and 2024 in the two sub division of the Menchum South. The hypothesis therefore suggests that there is no significant difference in the spatio-temporal expansion of coffee and oil palm plantations within Menchum South between 1994 and 2024. The results were presented in tables and figures to better understand the dynamics of these agro-plantations over time.

5. Results

The presentation of results was guided by the variables specified in the topic for appropriate discussion. As a consequence, the results were presented in two phases being the spatio-temporal dynamics of coffee and oil palm plantations and the analysis of dynamic parameters over time between 1994 and 2024.

5.1 Spatio-temporal dynamics of coffee and oil palm in the Menchum South

The results presented here consider the spatial changes in the surface area occupied by coffee and oil palm in the Menchum South between 1994 and 2024. The dynamics of these small scale agro-plantations was captured in the two sub divisions of the Menchum South being villages in Wum Central (Aghem, Bu, Bangwe and Aguli) and that of Menchum Valley being (Befang, Benakuma, Modele and Benade. Findings present that small scale coffee and oil palm plantations between 1994 and 2024 revealed significant changes in surface area under cultivation. The small scale coffee and oil palm plantationists have revealed mixed interests in maintaining and expanding the surface area of coffee or oil palm. This explains why the spatio-temporal dynamics presenting a situation of expanding oil palm fields against coffee plantations in the Menchum South (Figure 2).

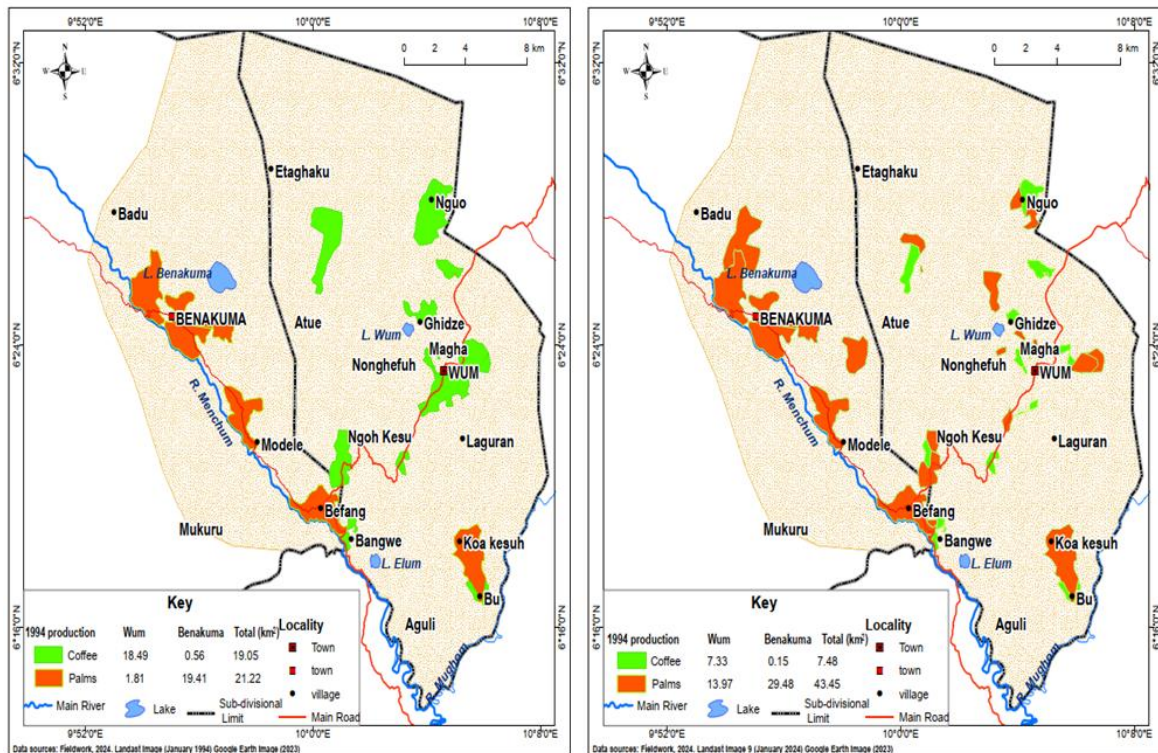


Fig 2a: Spatial coverage of coffee and oil palm as of 1994 in the Menchum South Fig 2b: Spatial coverage of coffee and oil palm as of 2024 in the Menchum South

Source: Landsat Image (1994) and Google Earth Image (2024)

Findings revealed a significant change in the spatial dynamics of small scale coffee and oil palm plantation in the Menchum South between 1994 and 2024. An assessment of the spatial view presents that coffee plantations have decreased while oil palm plantations have increased between 1994 and 2024. The results of map to map analysis show that coffee plantation occupied surface area of 19.05km² as of 1994 in the Menchum South. In much the same way, the analysis revealed that oil palm occupied surface area of 21.22km² in 1994 in the study area. In 2024, coffee plantation occupied about 7.48km² of surface area while oil palm occupied about 43.45km² of surface area in the Menchum South. This indicates 11.57km² decline in the surface area under coffee plantation between 1994 and 2024. The decrease in the surface area under coffee plantation justifies the declining interest coffee

farmers have towards this agro-coffee business thereby facing challenges with other agro-plantations in the Menchum South. In a similar manner, oil palm plantation experienced an increase of 22.23km² in oil palm plantation between 1994 and 2024. This increase justifies the development of agro-palm plantations in the Menchum South which has become an important economic activity and source of income to the population. The spatio-temporal concentration of small scale coffee and oil palm plantations equally vary from one village to another within the Menchum South.

The spatial view and changes in the surface areas under these small scale agro-plantations was equally quantified by gathering responses from the small scale coffee and oil palm plantation owners in the Menchum South (Table 1).

Table 1: Quantified perception of plantation owners on changes in small scale coffee and oil palm plantations in the Menchum South

Variable options	Freq.	Percent	Valid Percent	Cumulative Percent
Coffee to oil palm only	75	51.7	52.8	52.8
Oil palm to coffee only	18	12.4	12.7	65.5
Expand the existing oil palm	38	26.2	26.8	92.3
Expand the existing coffee farms	11	7.6	7.7	100.0
Total	142	97.9	100.0	100.0

Source: Field work (2025)

The results in Table 1 revealed that small scale agro-plantation owners in the Menchum South have experienced dimensional changes over time. The results of the analysis showed that a smaller proportion of plantation owners (7.7%) have expanded their existing coffee plantations over time. Since the economic depression in the 1990s, coffee lost its value in the world markets with most farmers no longer seeing the need to invest or expand their coffee plantations. The expansion of the existing coffee plantation specifically involved acquiring new areas or increasing the existing surface area under cultivation. However, about 12.7% of the plantation owners were of the view that they have expanded their plantations from oil palm to coffee plantation. About 26.8%

of the population opined that they have expanded their existing oil palm plantation through adding of land for cultivation or converting coffee plantations to oil palm plantations. Majority of the plantationists (52.8%) revealed that they have change from coffee plantation to oil palm plantation. This is due to the economic value of oil palm and the ready market for the products which have motivated plantationists to expand their oil palm plantations. Figure 3 shows oil palm plantation in previously cultivated coffee plantation with traces of coffee growing under oil palm plantation in Modele. Findings showed that this surface area was under coffee plantation.



Figure 3: Mixed coffee and oil palm plantations in Modele

Source: Fieldwork (2025)

However, with the regular fluctuation of coffee prices and low productivity together with low turnover, the owner of the coffee plantation transformed this surface area to oil palm plantation. According to field findings, oil business is more productive than coffee in today’s economy and also, coffee is more easily attacked by climatic changes than oil palms.

5.2 Parameters to spatio-temporal dynamics of small scale coffee and oil palm

Field investigation equally identified the determinants or parameters necessitating the spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South (Table 2). The assessment shows that about 13.4% of the plantationists

were of the opinion that the spatio-temporal expansion of small scale coffee and oil palm in the area is triggered by increasing demand for the products. This value was equally revealed by access to vast land which acts as motivating factor to the expansion of these plantations. The results further revealed that the search for suitable climatic conditions accounted for about 6.3% trigger to the dynamics of these small scale plantations. Climate varies with the

nature of the topography and since the study area presents varied degree of topographic variations, the climatic conditions equally differ. In a similar way one does not expect the northern zone to have the same rainfall and temperature conditions as the southern zone. This however, to an extent explains or justifies the spatio-temporal variation in small scale coffee and oil palm plantations in the Menchum South.

Table 2: Parameters to spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South

Variable options	Freq.	Percent	Valid %	Cumulative %
Access to vast land	19	13.1	13.4	13.4
Search for suitable climatic conditions	9	6.2	6.3	19.7
Search for fertile soils	28	19.3	19.7	39.4
Increase desire to invest	36	24.8	25.4	64.8
Access to financial credibility	14	9.7	9.9	74.6
Availability of cheap labour	17	11.7	12.0	86.6
Increasing demand for the products	19	13.1	13.4	100.0
Total	142	97.9	100.0	100.0

Source: Field work, (2025)

The availability of cheap labor (12%) and access to financial credibility (9.9%) are some of the determinants that triggered the spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South. Meanwhile, majority of the plantation owners (25.4%) held the view that the increase desire to invest in agro-plantation business has been the main determinant to

spur up the spatio-temporal expansion of small scale agro-plantations of coffee and oil palm in the Menchum South. Field investigation relates the spatio-distribution of soil types and the spatio-temporal density or distribution of both oil palm and coffee plantations in the Menchum South (Figure 4).

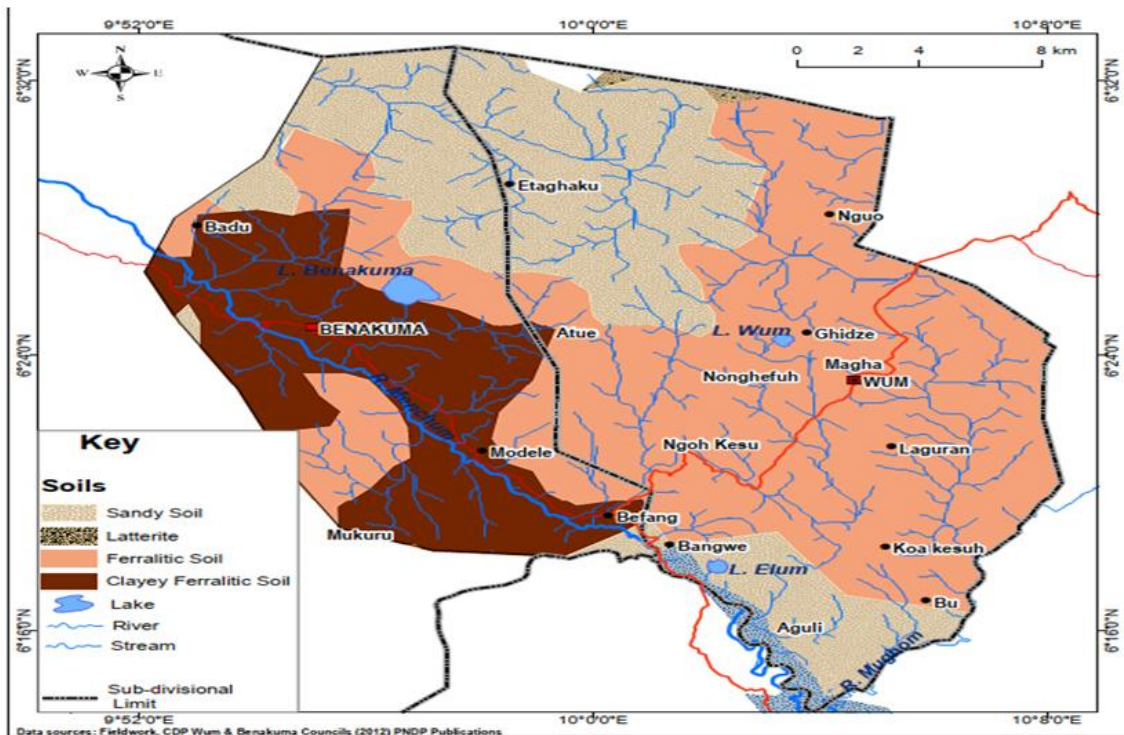


Figure 4: Spatial distribution of soil types in the Menchum South

Source: ArcGIS and Field work, (2025)

Findings revealed that the search for fertile soils remains one of the outstanding determinants to the spatio-temporal dynamics of small scale coffee and oil palm plantations in the Menchum South. This is so because the study area presents different soil characteristics and types which to a greater extent explains the concentration of coffee and oil palm plantation between the northern and southern zones of the Menchum South. The study area therefore revealed four different soil types being the sandy soil which dominates the

North Eastern part of Menchum South and the southern slopes of Menchum South covering areas such as Aguili and Eteaghkuh. The ferralitic soil cover most of the slopes within the Menchum Soil while the clayish and alluvial soils are most found within the South Western slopes of Menchum South. Figure 5 presents a summary of the dynamics of small scale agro-plantations in the Menchum South.

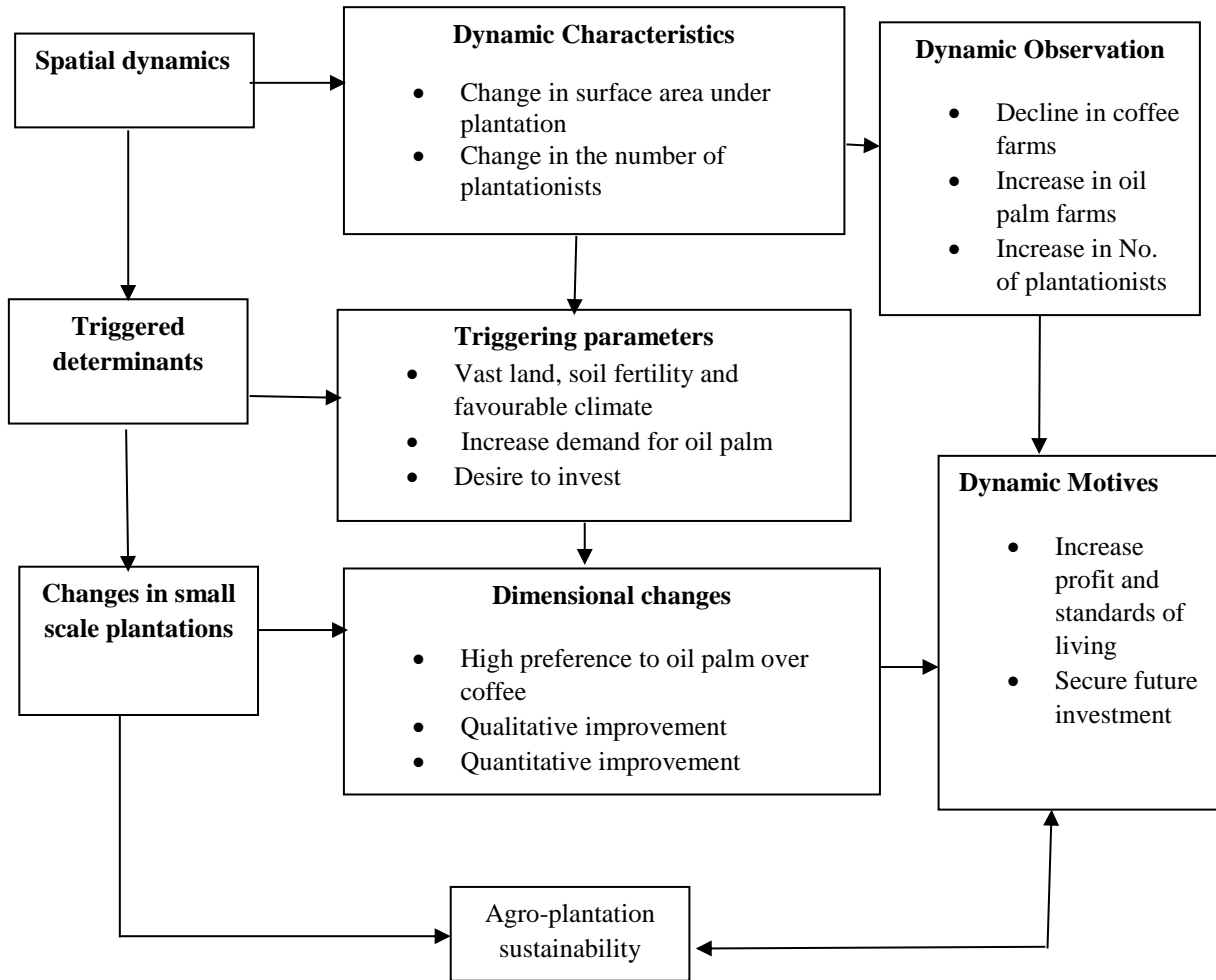


Figure 5: Conceptualization of small scale agro-plantation dynamics

Source: Conceived by Authors (2025)

The framework in figure 5 summarizes the dynamic characteristics of small scale coffee and oil palm plantations establishment in the Menchum South. The framework shows a close relationship between spatial dynamics, triggered determinants and the observed changes in small scale agro-plantations in the Menchum South. The framework further reveals how spatial dynamics ignites dynamic characteristics resulting in observed dynamic changes in agro-plantations. As a result, changes in the number of plantationists and surface area under coffee and oil palm plantations is observed through decline in coffee farms, increase in oil palm farms and increase in increase of plantationists in the area. The dimensional changes however follow the motive of opening up small scale plantations backed by socio-economic benefits.

6. Discussion

The spatio-temporal dynamics of coffee and oil palm plantations in the Menchum South revealed an inverse relationship. This is so because coffee farms have been decreasing while oil palm plantations increase over time. The findings to this dynamic pattern are explained the growing demand of oil palm as well as the economic value of oil palm business. Also, with the great prospects to intensify and diversify agro-plantations households are becoming motivated to invest in small scale plantation activities. The results of Ayompe *et al.*, (2021) revealed similar pattern of agro-farmers shifting their interests to economically advantage cash crops to improve their living conditions.

The triggers to agro-plantation expansion were identified through the search for vast land, availability to credits, cheap labour, climate, soil and topographic influence. The results showed a direct relationship between these factors and dynamics of small scale plantations under favorable conditions in the Menchum South. This correlation trend is different from the findings of Nchanji *et al.*, (2016). Accordingly, the results show strong negative correlations between factors affecting palm oil yield and the adoption of innovations to increase yield, and between the adoption of methods to manage palm oil processing and most common production losses. The management of oil palm processing to prevent losses was not considered in this study.

The results for this study revealed several factors necessitating the dynamics of small scale coffee and oil palm plantations in the Menchum South. The availability of vast and cheap land is amongst the driven parameters. Hence, there is little of no concern regarding land grabbing or scarcity to precipitate expansion. This finding therefore makes the study of Apriani *et al.*, (2020) different from this study. Though, both studies hold that oil palm and its by-products profitability contributes to the sustainability of the oil palm sector. In the global palm oil commerce, an endeavor known for its extensive land usage with millions of hectares dedicated to palm tree cultivation, various techniques have been employed by major players, notably in countries like Malaysia and Indonesia, to acquire land. One such technique is referred to as "land grabbing," akin to the unlawful acquisition of territory.

In South East Asia, millions of smallholder farmers have transitioned over the past decades from cultivating rubber to oil palm to supply the more lucrative and diversified palm oil market (Shaw *et al.*, 2018 and Tan, 2014). This approach is quiet similar to the findings in the Menchum South whereby about 45.5% of the population have changed from coffee plantation farming to oil palm plantation farming. According to the findings, the shift from coffee to oil palm agro-plantation establishment is because of the lucrative nature of oil palm plantation with relative high demand and low fluctuation of prices.

7. Conclusion

Small scale agro-plantations especially coffee and oil palm have contributed enormously to the socio-economic livelihoods of the population in the Menchum South. whilst such investments is considered as livelihood surviving strategy to many, the dynamics in this sector is quiet visible given the commercial purpose of these products. Changes in small scale coffee and oil palm have been observed through reluctant of most coffee farmers to expand their plantation or invest in the activity because of low profits. The oil palm sector continues to gain the market share given the high demand of oil palm in most households. This has precipitated the dynamics in land acquisition, converting coffee farms into oil palms, opening up of new oil palm plantations as well as importation of modern palm species to ensure high productivity. However, the new trend of oil palm demand by neighboring Nigeria is a sign to ensure a ready market for oil palm. Consequently, this study recommends the need to shift the practice of small scale coffee and oil palm to large scale to satisfy the local, national and international demands. Also, the establishment of coffee or oil palm plantation requires high capital and as a result, the state and other NGOs should engage to fund the development of large scale agro-plantations especially the oil palm and coffee

sectors in this area. The tendency is to ensure agro-base plantation development sustainability in Menchum Division as well as the country at large.

References

1. Apriani, E., Kim, Y. S., Fisher, L. A., & Baral, H. (2020). Non-state certification of smallholders for sustainable palm oil in Sumatra, Indonesia. *Land Use Policy*, 99, Article 105112. <https://doi.org/10.1016/j.landusepol.2020.105112>.
2. Ayompe, L.M., Nkongho, R.N., Masso, C., Egoh, B.N. (2021): Does investment in palm oil trade alleviate smallholders from poverty in Africa? Investigating profitability from a biodiversity hotspot, Cameroon. *PLoS ONE* 2021, 16(9): e0256498. <https://doi.org/10.1371/journal.pone.0256498>
3. Borrás S M & J C Franco (2011): Political Dynamics of Land-grabbing in Southeast Asia: Understanding Europe's Role. Transnational Institute, Amsterdam.
4. Byerlee, D., Falcon, W.P. Naylor, R.L., (2017). *The Tropical Oil Crop Revolution: Food, Feed, Fuel, and Forests*. Oxford University Press.
5. Carlson, K.M., Curran, L.M., Asner, G.P., Pittman, A.M., Trigg, S.N., Marion Adeney, J., (2012). Carbon emissions from forest conversion by Kalimantan oil palm plantations. *Nature Climate Change* 3, 283-287. DOI: 10.1038/nclimate1702
6. Chege J. (2012). Value Addition in the Coffee Industry in Kenya: Lessons from the Cut Flower Sector. KIPPRA, Nairobi.
7. Colchester M (2011) Palm Oil and Indigenous Peoples in South East Asia: Land acquisition, human rights violations and the indigenous people on the oil palm frontier. *Forest Peoples Programme & ILC*. Available at: <forestpeoples.org/sites/fpp/files/publication/2010/08/palmoil_indigenous_peoplesoutheastasiafinalmceng_0.pdf>
8. Danida. (2012). Kenya Coffee Producers Association - Business Advocacy Fund.
9. FAO, (2017): FAOSTAT statistics database. Food and Agriculture Organization of the United Nations. FAO, Rome. 677.
10. Feintrenie, L., (2014). Agro-industrial plantations in Central Africa, risks and opportunities. *Biodiversity & Conservation* 23, 1577-1589. DOI: 10.1007/s10531-014-0687-5 679
11. Gaveau, D.L.A., Sheil, D., Husnayaen, Salim, M. A., Arjasakusuma, S., Ancrenaz, M., Pacheco, P. (2016): industrial plantation expansion in Borneo. *Scientific Reports* 6, 32017. DOI:10.1038/srep32017.
12. Henders, S., Persson, U.M., Kastner, T., (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters* 10, 125012. DOI: 10.1088/1748-9326/10/12/125012
13. ICO, (2013) (http://www.ico.org/trade_e.asp) retrived on 6/01/2014

14. Levang P and Nkongho RN (2012). Elites et accaparement des terres au Cameroun: L'exemple du palmier à huile. *Enjeux* 47-48:67-74
15. Nchanji, Y. K., Nkongho, R. N., Mala, W. A., & Levang, P. (2016). Efficacy of oil palm intercropping by smallholders. case study in south-west cameroon. *Agroforestry Systems*, 90(3), 509-519. doi: 10.1007/s10457-015-9873-z
16. Ordway, E.M., Asner, G.P., Lambin, E.F., (2017). Deforestation risk due to commodity crop expansion in sub-Saharan Africa. *Environmental Research Letters* 12, 044015. DOI: 767 10.1088/1748-9326/aa6509
17. Shaw, S., Jai-In, S., & Juntopas, M. (2018). Fueling transformation in the Mekong: Thailand's trade in agro-energy. In M. I. Lopez & J. Suryomenggolo (Eds.), *Environmental resources use and challenges in contemporary Southeast Asia: Tropical ecosystems in transition (Asia in Transtion vol. 7) (pp. 41-75). Springer.* https://doi.org/10.1007/978-981-10-8881-0_3.
18. Tan, H. (2014, August 12). Thailand encourages rubber farmers to switch crops. *The Wall Street Journal*. <https://online.wsj.com/articles/thailand-encourages-rubber-farmers-to-switchcrops-1407839494>
19. TFA (Tropical Forest Alliance 2020), 2017. Africa Palm Oil Initiative. URL <https://www.tfa2020.org/en/activities/african-palm-oil-initiative/> (accessed May 2017).
20. Waston, K. and Achinelli, M.L., (2008). Context and contingency: the coffee crisis for conventional Small Scale farmers in Brazil. *The geographical journal* 174 (3) 223-234.
21. Wum Council Report, (2018): Annual Statistics Book