OPAL - PROJECT
REPORT OF FIELD SURVEYS AND SOILS SAMPLE COLLECTION IN THE BOGSO VILLAGE (NYONG KELLE DIVISION) AND NGWEI COMMUNITY (SANAGA MARITIME DIVISION)

IMPACTS OF OIL PALM INTERCROPPING ON SOIL FERTILITY, INCOME AND PRODUCTIVITY

February 2018
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Introduction

The conversion of forest ecosystems for oil palm agro-ecosystems is becoming increasingly important in the tropics. It thus contributes, for a large part to cash farming, one of the engines of the economy of the developing countries promoting this type of agriculture. In Cameroon, the oil palm systems are expanding rapidly, with several production areas such as the South West Basin, the Sanaga Maritime Basin, the Nyong and Kellé belt, the Dja and Lobo basin and Kribi basin. The smallholders palm plantations are booming, representing the new modified habitats.

Roundtable on Sustainable Palm Oil (RSPO) describes them as adjoining palm plantations with high conservation values (Vermeulen and Goad, 2006). These agro systems have quite specific characteristics: intercropping in young palm plantations and lack of mineral fertilization during the entire crop cycle. The research question that raised up is whether the sustainability of the oil palm production system and the capacity of the soil to respond favorably to nutritional needs make it possible to maintain soil fertility? A first step of the palm plantations typology diagnosis made it possible to note that they mainly belong to the small producers. However, some elites have palm plantations with sizes very close to agro-industries areas. Moreover, beyond the generalizing nature of the oil palm production systems, are the smallholders applying the nutritive solutions in a systematic way in their palm plantations as it is the case with the agro-industries?

Oil palm is part of the WWF’s landscape current activities in Cameroon through the "Oil Palm Adaptative Landscape" (OPAL) project, which is jointly implemented by CIFOR, the PDPV (Ministry of Agriculture and Rural Development-MINADER), and WWF. WWF is closely monitoring the deforestation and loss of biodiversity related to oil palm in Cameroon, particularly those underway in the Sanaga Maritime (Ngwéi), the Ndian (Ekondo Titi) and Nyong & Kellé (Eséka) Basins which are areas of large oil palm production still holding high value forests for conservation. Although the oil palm has a positive socio-economic impact in terms of employment and income, it can be considered that this crop has a negative impact on the soil and the environment when it replaces forests (Tchindjang et al., 2016). In this case, logging and burning of tropical forests for the establishment of this monospecific crop would drive to the loss of soil organic matter while damaging soil resistance. This has led to the current research entitled "Impacts of intercropping in oil palm plantations on soil fertility, plantation productivity and incomes". It implies a socio-economic dimension based on the productivity of the oil palm plantations, intercropping and characterization of farmers' incomes.

Objectives

This project aims at demonstrating that oil palm intercropping with food crops increases the food and economic security of smallholders in Cameroon while mitigating the loss of ecosystem services associated with oil palm. It also aims at assessing alternative oil palm management practices to maximize their economic, social and environmental sustainability. Negative environmental impacts of the worldwide expansion of oil palm cultivation have recently raised much concern in the scientific and civil society (Clough et al., 2016). However, research has been limited mostly on quantifying the negative impacts of natural forest conversion on greenhouse gas emission, biodiversity loss or soil degradation in Malaysia and Indonesia (Guillaume et al., 2015), land degradation in Cameroon (Tchindjang et al. 2015).
Despite the dramatic past and predicted expansion of this crop, little attention has been paid on alternative oil palm cultivation practices that would mitigate environmental and social negative impacts. The study will emphasize on the impact of the forest conversion on soils chronosequences in elitist and smallholders palm plantations. To achieve this goal, field trips were organized to Bogso and Ngwéi to collect palm plantations soils and forest soils samples. Simultaneously, socio-economic surveys were conducted. Specifically, the following tasks were carried out:
- Observations and macroscopic description of the soil horizons in forest and palm plantations;
- collecting soil samples in chronosequences of forest and palm plantations for physico-chemical analyzes;
- measuring the above-ground biomass in the various palm plantations surveyed;
- measuring the root biomass in the surface horizon;
- conducting socio-economic surveys to estimate the intercropping practices among smallholder farmers.

Pending the results of the treatment of survey questionnaires and those of soil analyzes by the IITA laboratory, this report will be organized around 3 main areas of interest: preliminaries and generalities; socio-economic surveys; samples collection and pre-processing.

1. Preliminaries and generalities

1.1. Defining the theme
Mesmin and Thomas had a Skype interview on December 13, 2017 to discuss the content of the research kit and to edit a research file, as well as the various aspects related to observations and field data collection. Both agreed on the setup of the research permit file. On January 31, Mesmin submitted the file to Cameroon Ministry of Scientific Research and Innovation (MINRESI) on January 31, 2018. The main elements of this file are attached to this report (Appendix 1). In the meantime, both exchanged on the framing of the study and the INOPALM project which unfortunately has not been funded. This situation does not prevent further work on intercropping in Cameroon.

1.2. Cameroon stay of Alexandre BUTTLER and Thomas GUILLAUME
Thomas GUILLAUME and Alexandre BUTTLER arrived in Cameroon on Monday, January 8, 2018. The following day (January 09), a meeting was organized at WWF at 2:00PM to define the outline of this Swiss team visit in Cameroon. Participants at the meeting were: Ludovic MIARO III, Micresse KAMTO, Fideline MBORIGONG (WWF), Jonathan Pierre Emmanuel NGOM (MINADER), Thomas GUILLAUME, Alexandre BUTTLER and Mesmin TCHINDJANG (University of Yaoundé I). The exchange focused on intercropping, soil monitoring systems with or without fertilization on different sites (forest, oil palm smallholders’ plantations of more and less than 20 years, agro industries etc.). This meeting allowed us to schedule the field mission date in Nyong and Kellé, Ngwéi and Buea-Limbe for Monday, January 15th. Mesmin was responsible for dealing with the aforementioned issue of the MINRESI research permit. Emmanuel should take care of the various contacts with the plantation owners on the different sites.

Among other resolutions of this important meeting, our hosts wanted to see and touch what is being done in Cameroon in terms of soil analysis. Decision was made to visit some
laboratories: the University of Yaoundé I, the Centre for Biotechnology and IRAD Nkolbisson labs.

A meeting was held at the GMEM head office in Melen on January 10 followed later by another one at the University of Yaoundé I in the afternoon with Prof. Monique ABOSSOLO of the Faculty of Science, Dr. Damien Marie ESSONO and two prospective students to benefit from the supervision of this project in their works: ONGBIBOU BAKANDA Edith (MSc student) and MESSENDE MBA Benoit Landry (PhD student). On the sidelines of this meeting, the team visited the soil science laboratory of the Faculty of Sciences.

1.3. First joint field missions

On January 11, Mesmin & Damien Marie (Cameroonian team) and Alexandre & Thomas (Swiss team) were deported to Nkolbisson to visit the laboratories of IRAD and the Centre for Biotechnology belonging to the Faculty of Sciences.

On January 15th, the team composed of Alexandre, Thomas, Mesmin, Damien, Benoit Landry and Emmanuel NGOM traveled towards Bogso where we spent the day in the oil palm plantations belonging to Mr. NDENGA NYEMECK Jean Paul (Owner of GIC Extension agro-industrial Bogso - VAB). After visiting, watching and discussing on the practices and main issues of intercropping management with the owner, the team left in the afternoon for Edéa where we spent the night.

On January 16th, we headed for Njock Loumbé in the Ngwéi Council. There, the team visited Mr. SEND MAKANG Salomon oil plantations which is located at the edge of a dense forest. The exchanges focused on the same theme coupled with the use of fertilizers and productivity. After surveying other smallholders’ oil palm plantations, we left Ngwéi for Limbe where we arrived at dusk.

On January 17, 2018, our work was organized around three oil palm plantations, including that of Theodore NGU in Buea and then two other plantations in Limbe and Bakingili. We were edified by Theodore on integrated oil palm cultivation (palm plantations, intercropping and poultry / piggery). We spent the night in Limbe before heading back to Edéa and Yaoundé the next day while Alexandre, Thomas and Damien went to Kribi.

We held a debriefing meeting at Atlantic Beach Hotel on January 17th at 6:00 PM. the exchanges covered the general observations of the three previous days fieldwork, in particular the tests on organic farming and soil restoration, the problem of soil fertility gradient according to the density of the intercropping necessary for small producers, the ages of intercropping at the different scales observed and the impacts of forest conversion for oil palm cultivation.

Given the prevailing security situation in the Southwest region, only Nyong and Kellé and Ngwéi in the Sanaga Maritime will benefit from current research on intercropping, even if it will be extended to the Southwest administrative region in the near future.

1.4. Geographical presentation of the two visited sites

Bogso and Ngwéi are the main studied areas. They actually form an ecological continuum beyond even if they belong to different administrative divisions. The annual average
rainfall varies between 1500 and 2000 mm. The distribution of the rainfall regime is bimodal. The climate is equatorial with two dry seasons and two rainy seasons of equal length. Relief features are relatively flat, the vegetation is dominated by a dense semi-deciduous forest with *Sacoglottis gabonensis* and *Lophira alata*. The soil cover consists of ferrallitic soils with sandy-clay texture. The color of the soil varies from brown to red. Field observations show that these soils are fertile in some areas, they allow the practice of an integrated agriculture associating several crops, but whose perennial dominant culture is the oil palm.

The related investigations were carried out in the divisions of Nyong and Kellé (Bogso) and Sanaga Maritime (Ngwéi Council). In these two administrative units, the survey specifically aimed at highlighting the singular characteristics of palm plantations; intercropping; data on the use or non-use of fertilizers by the farmers; the impact of these last two aspects on soil fertility (which remains to be determined by in-depth laboratory analyzes) as well as oil palm plantations productivity and associated income.

On each of these aspects, as mentioned, at the beginning of this report, the research identifies the respective proportions of palm plantations that were or were not intercropped. Also, the main targeted information related to: the nature of the vegetal cover that allowed the creation of the oil palm farms (primary, secondary, old or young fallow forest, etc.), the date of the forest clearing, the date of the palm planting, the spatial structure of the plantations (size of fields and distance between plants), the type of genetic material used (both for palm and intercropping), the beginning of harvest and the date of intercrops planting. As far as land fertilization is concerned, the surveys succeed in identifying the type of fertilizer used (organic or inorganic) and for each type, its specificities. There is also the level of the fertilizers used, the quantities used at each stage, the acquisition cost of these fertilizers and their impact on yields (see questionnaire in Appendix 2).

On this last aspect, yields are to be assessed globally at the scale of the palm farm and all intercrops over a given harvest period. Also, yields for the palm plantations, take into account the various palm oil extraction tools available to the farmers (industrial, semi-industrial, motorized extraction, hand and craft press, etc.) or the production cost of sale without transformation. But, in the unique case of intercropping, these yield estimates are also backed up by crop type as well as by crop season.

2. Socioeconomic surveys in Nyong & Kellé and Sanaga Maritime Divisions

2.1. Investigations in the Nyong & Kellé

2.1.1. Period and investigated site

First of all, in Nyong and Kellé preliminary surveys were held throughout the division from 07 to 14 December to observe and establish a diagnosis of oil palm areas in the zone. We went through the localities of Makak, Eséka, Biyouha, Matomb, Botmakak, and Ngog-Mapubi.

Secondly, investigations took place from 25 to 27 January 2018, then from 29 January to 02 February for the soil samples collection in the locality of Bogso. Bogso is the first village in the Eséka Council (Nyong and Kellé division), one of the main oil palm production basins in Cameroon. Locally, the surveys favored the semi-cooperative oil palm farms (GIC VAB of Mr. Jean Paul NDENGA NYEMECK) with an area of about 222 ha.
2.1.2. Palm plantations characteristics

Interviews with the president and other members of this cooperative revealed early trends in the characteristics of the oil palm farming and intercropping in the locality. The plots investigated are summarized in figure 1 below (we did not sample in the oil palm plantations of 2012, 2013, 2016 & 2017).

Spacing between the palm feet is 9m equilateral triangle, for a total of about 150 palm feet per hectare. The cultivated variety is *tenera* produced by the Institute of Agronomic Research for Development (IRAD) and PAMOL.

VAB Cooperative at Bogso employs 102 people for the maintenance and exploitation of the oil palm farm, including 25 permanent and 77 temporary / seasonal. These workers come from all parts of Cameroon. It should be noted that the weeding of the different oil palm plots is done by spraying herbicides.

2.1.3. Intercropping

The respondents argue that intercropping become a reflex. "The husband creates the oil palm farm and the wife plants the food crops", says the president of the cooperative. These intercrops are set up at the time of the establishment of the oil palm plantation. They are gradually eliminated according to their harvest cycles. It is better to mention that plantain banana is directly cultivated after clearing. However, if the oil palm farm is established on a fallow land, the crops found there are the following:

- Plantain banana,
- Corn,
- Cassava
- Peanuts
- Cucumber
- Yams
- Potatoes
- Papaya
- Tomato

The cooperative has also experimented unsuccessfully the intercropping with pineapple. But according to its president, this experiment was not conclusive because sales opportunities were difficult.

Spacing between two (02) banana plants is regular. It is on average 3m and at least 2m from the palm foot. Other speculations are grown at random. Also, unlike other intercropping, plantain is a little longer (nearly 3 years) in the plantation until it dies under the effect of the competition of the palms growth.

**2.1.4. Soils fertilization**

Fertilizers, organic and inorganic, are used for both palms and intercrops. Tables 1 and 2 below summarize the proportions / volumes of fertilizer used for each type of the crops at the different growth stages of the oil palm plantations.

**Tableau 1**: use of fertilizers in oil palm plantations

<table>
<thead>
<tr>
<th>Organic fertilizers</th>
<th>Stalks + rubbish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inorganic fertilizers by palm plant</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Phases</strong></td>
<td><strong>Fertilizer</strong></td>
</tr>
<tr>
<td>Growth Phase (0 – 3 year)</td>
<td>Urea</td>
</tr>
<tr>
<td></td>
<td>Potash</td>
</tr>
<tr>
<td></td>
<td>kieserite</td>
</tr>
<tr>
<td>Production phase</td>
<td>Urea</td>
</tr>
<tr>
<td></td>
<td>Potash Chloride</td>
</tr>
<tr>
<td></td>
<td>Magnesium (kieserite)</td>
</tr>
</tbody>
</table>

Organic fertilization includes, beyond bunches and other wastes, also maize residues around the palms feet (about 3 years are needed for total effects) and banana plantain, macabo or cassava intercropping waste.

As intercropping is concerned, fertilization is mainly used for plantain when planted in a fallow, rather than in the forest. Table 2 below summarizes the dosing volumes.

**Table 2**: use of fertilizers for plantain

<table>
<thead>
<tr>
<th>Growth stages</th>
<th>fertilizers</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 days after planting</td>
<td>Urea</td>
<td>Soup spoon</td>
</tr>
<tr>
<td>2nd month</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd month</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th month</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th month</td>
<td>Urea + potash chloride + NPK (for flowering)</td>
<td>50 à 100g</td>
</tr>
<tr>
<td>6th month</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7th month</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As soon as the dry season is announced, the plant use osmosis phenomenon to avoid loosing of water by living in latency. At the 8th month, no more fertilizer is used, except for secondary offspring. Plantain is also protected against enemathote and other weevils by simply pruning the leaves.

2.1.5. Production and yield

The production of oil palms and intercropping (including plantain) varies with age, the type of genetic material used and the maintenance of plantations. For palm plantations,
- at 3 years, first harvest (sanitary harvest);
- From 4 years old, first yield profits that intensify over time to reach the paroxysm between 6 and 8 years.
- Also, if the farmers respect the fertilizers dosage, they will yield:
- 14 tons of bunches / ha × 4 fruits bags × 55 liters = 3080 liters = 3 tons of palm oil.

It is worth mentioning that financial returns from the sale of palm oil vary considerably with the seasons. In high season, the litre of palm oil is sold at 300 XAF (0.56 $US). It goes to 600 XAF (1.12 $US) in low season (wet season).

- 3080 litres × 300 XAF = 924,000 XAF (1730.34 $US)
- 3080 litres × 600 XAF = 1,848,000 XAF (3460.67 $US)

Palm oil is extracted by artisanal mill (photo 1). It can be kept for 6 months in its natural state without any treatment. But after this period, one must take special precautions for its better conservation.

Photo 1: artisanal mill for palm oil production in Bogso

Regarding intercropping and singularly banana plantain crops, information obtained indicates that on 1 ha of oil palm farm, an average of 700 plantain plants are grown. According to the harvest periods, Table 4 summarizes the different productions and financial returns are as follows.

---

1 On March 20, 1$US = 534 XAF
Tableau 4: plantain production at Bogso

<table>
<thead>
<tr>
<th>Period</th>
<th>Number of stems harvested</th>
<th>Unit selling price (XAF)</th>
<th>Total income (XAF)</th>
<th>Total income ($ US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>500</td>
<td>1000</td>
<td>500,000</td>
<td>936.33</td>
</tr>
<tr>
<td>6 to 7 month after</td>
<td>300</td>
<td>300,000</td>
<td>561.80</td>
<td></td>
</tr>
<tr>
<td>6 to 7 month after</td>
<td>150</td>
<td>150,000</td>
<td>280.90</td>
<td></td>
</tr>
</tbody>
</table>

In terms of sample collection, 188 soil samples were taken at Bogso and pre-treated (conditioned) for 5 days by Thomas, Damien and Benoît Landry. They have been submitted to IITA for analysis according to well-defined parameters linked to the expected results.

2.2. Investigations in the Sanaga Maritime

2.2.1. Period and survey sites

Investigations took place in the Ngwéi council from 20 to 24 February in about fifteen villages (Njock Loumbé, Digombi, Makek, Seppe, Mbandjock, Makondo ...). One hundred and ten (110) questionnaires were administered to the farmers of this council. The aim was to highlight the characteristic features of oil palm farms and intercropped plantations in the targeted localities.

2.2.2. Palm plantations Characteristics

Excepted a few large size palm plantations (more than 10 hectares) that still exist in this council, most of the plantations are small family farms (using family labor). Average surface generally does not exceed 3 ha. Unlike Bogso, its maintenance is done exclusively by clearing and pruning old palms stalks.

Cultivated germplasm alternates between *tenera* and "tout venant" (Local name of the unselected oil palm plant). This results from the individual experiences of the farmers’ vis-à-vis the lack of financial means to acquire the selected productive varieties. The spacing between the palm trees feet varies between 7 and 9 m giving way to a total of 143 to 155 feet per hectare. Such a spacing greatly influences productivity and yields.

The general profile of the oil palm cultivation in the Ngwéi district alternates very old, adults and young plantations. Old palm plantations (more than 30 years old) are the result of government policy in the 1970s which aim at developing oil palm cultivation in the area and which SOCAPALM has the privilege of flying. Populations were receiving free quality genetic material, money for the clearing of the forest and were accompanied technically throughout the process of establishment and maintenance of their plantations. However, they had the obligation to deliver their production at a fixed price to SOCAPALM.

Adult (15 - 25 years old) and young (<15 years old) palm farms mark the fronts of recent extension of the oil palm cultivation within the district. It grew in the 1980s and 1990s with the economic crisis in Cameroon and the "return to the land" movement brought about by this crisis. The information gathered suggests that urban elites played a catalytic role in this dynamic of oil palm farming development throughout the municipality.
2.2.3. Intercropping

Intercropping is extremely widespread in the Ngwéi council (photo 2). It seems to become a standard for almost all the farmers, excepting a few elitist plantations in the Njock Loumbé, Digombi and Mbandjock villages.

Photos 2: intercropping in Mr. Jean Paul palm plantation at Bogso

As it was described in the Nyong and Kellé, food crops constitute the bulk of intercropping and are introduced into oil palm farms at the time of their creation. Crops planted are:

- banana plantain,
- corn,
- manioc
- Peanuts
- cucumber
- yams
- potatoes
- papaya
- tomato

These crops are gradually eliminated over the harvest and especially following the oil palm growth stage. Intercropping is mainly culturally perceived through the prism of its food supplement and the economic benefits it provides through the sale of crop produce.

2.2.4. Soils fertilization

Paradoxically and contrary to Bogso, fertilization using inorganic (and even organic) fertilizers is not very developed in Ngwéi council. When it is mobilized, it focuses on the young stage of palms (between 0 - 3 years). Afterwards, plantations generally evolve without any fertilizers the addition. Similarly and throughout the municipality, fertilizers are not generally used for intercropping, except occasionally and punctually.

2.2.5. Production and yields

Yields considerably varied from one plantation to another. These fluctuations mainly concern, (as palm oil is concerned), the type of genetic material, the difference between the palm feet, the maintenance of the plantation including also the local soil conditions.
The production of bunches is intended either for direct sale to companies located in the Douala economic capitals; or to the local extraction of palm oil. The latter is widely spread in the municipality and is generally done in a traditional way (use of manual presses, photo 3 A). Nevertheless, some semi-industrial and industrial installations exist respectively at Makondo (photo 3 B) and Njock Loumbé, serving only to the purposes of their owners.

Overall, there is a lack of agricultural statistics (no production records and yields) in terms of both volume and number of plants per hectare and harvest quantities. For the specific case of palm oil, the amount of fruits bunches and liters of oil obtained per hectare as well as the financial income drawn remained unknown. Information given on production and yields very often suffers from a lot of inaccuracies. These statistics are virtually irrelevant for intercropping farming which first serves the food supply of the population before its surplus products are sold on the market.

Palm oil production is generally evaluated in "tin" (22 litres). Per hectare, the statistics for artisanal mill varies between 12 and 34 tins or more. It is worth noting that some farmers do not exactly specify the quantities produced. This aspect will organizing future investigations to have an exact idea on the yields. As reported in Bogso, the price of a litre of oil varies between 300 and 600 XAF (0.56 and 1.12 $US) depending on the season. But during periods of high production, the price per litre can decline to 250 XAF (0.47 $US). Such a situation is partly due to the lack of effective means of long-term preservation.
Revenues from oil palm farming and intercropping are generally part of the household’s multiple expenditures and thus help to alleviate poverty and remove, as much as possible, the spectrum of famine within the municipality. In Ngwéi Council, 74 soil samples were collected, packaged and deposited at IITA laboratory for analysis.

3. Data collection

3.1. Preparatory phase

This step consisted in making a diagnosis based on farm surveys. It was intended for the realization of a typology of the smallholders and elitists in the big basins of oil palm production in Cameroon. This recognition phase lasted five (05) days. It was followed by another prospecting phase which lasted two (02) days in Bogso village. This last phase made it possible to get in touch and contact the owner of chrono-sequenced palm plantation. In addition, a final phase of 05 days (see Mission Order in Appendix 4) was used to collect data in the villages of Makondo, Digombi and Song Mblog (Ngwéi council).

3.2. Field phase

Fieldwork sampling took place alternately in Bogso and then in Ngwéi. Sampling was done on a chronosequence of 13 palm plantation, the oldest of which is 39 years old (with 03 forest sites) and the youngest is 04 years old.

In each oil palm farm studied, we begin by making a survey that allows us to see the physical constitution of the soil mineral elements and also to see if there are no traces of human activities in the plot. After this step, one delimits in each chrono-sequenced palm farm a square or rectangle area of variable dimensions. We then define an iso plane of \((y = x \text{ or } y = -x)\) of 05 palms. The demarcated area consists of 25 palm trees 9 m apart on average each. The coordinates are taken on the 1-1 of each palm farm, the samples are taken at 2 and 4 m palms 2-3 (A); 2-4 (B); 3-2 (C); 4-3 (D); 5-5 (E) to which a ribbon is attached. To do this, we measure with the end-to-end decameter the distance that separates the reference palm tree and its next one on the vertical. When this distance is known, we take its half in which we subtract 50 cm. This new point is located 4 m from the middle of the trunk of the reference palm from which we subtract 2 m and we have the new point located 2m from the radius of our reference palm. Samples in each palm farm are taken using a manual root auger and at a depth of 10cm. For deeper soil studies (up to 60 cm and 4 m from the palm tree 3-2 (C) in the sampling area), samples were collected at 0-15 cm, 15-30 cm, 30-45 cm, 45-60 cm depth using a manual auger. In total, 260 samples were taken.

Within the forest, after a sounding, we make a 50 m long and we take samples from the root auger with a depth of 10 cm. At point C, we go up to 60 cm with a manual auger for deeper forest soil floor studies. In total, we collected 21 forest samples. All the samples taken are put in the plastic bags numbered beforehand by a marker.

3.3. Characteristics of the palm plantations studied

The different oil palm plantations studied have varying ages ranging from 4 to 39 years. Heights also vary according to age. The majority of oil palm farms are pre mature to mature. We noticed two old palm farms of over 35 years old and two young oil palm plantations under 10 years old.
The stipes or trunks of the palm groves are invaded by ferns of the genus *Nephrolepis* which are strict epiphytes of the oil palm. But in the old palm farms, some trunks base are smooth and no longer contains ferns, while others are provided with organic matter.

The top soil (surface) of the various palm farm is mostly bare, with almost no litter. This soil is compact and carpeted by foam of the genus *Funaria*. It should be noted that Ngwéi’s oil palm agro systems are not fed by a nutrient solution as is the rule in Bogso. However, the 2014 Bogso palm plantation which was created after clearing mature forest still has loose soil, with the presence of large decaying dead trees and a good amount of organic matter. The pruned palms are laid on the line and parallel to standing individuals plants.

3.4. Characteristics of the nearby forest

The studied forest is a mature forest of about 40-45 years of age. The presence of degenerative anomalies on the cauliflower of certain arboreal individuals suggests the presence of slash-and-burn agriculture. We also noticed the presence of long-lived species that are between 25-30 years old, *Diospyros crassifolia*, *Santiria trimera*, *Coula edulis*, *Staudtia kamerunensis* and *Gilbertiodendron dewevrei*.

3.5. Description of the litter

The litter consisting of senescent leaves, twigs, barks and tree branches having a thickness of 5 cm and covering the surface of the soil continuously. It is divided into three sub-layers:

- A sub-layer consisting of whole and fragmented leaves of light brown color having a thickness of 2cm;
- A second thick sub-layer of 2cm made up of dark brown to blackish leaves perforated on the surface and gnawed on the edges, some of which have ribs;
- The third sub-layer of 1cm thickness which is at least incorporated to the soil presents a pile of shredded leaves

The various traces of activities recorded on the top soil mainly belong to the macro fauna (turbicles, termite mounds, anthills). Also, the vegetal carpet consisting mainly of leaves and twigs, shows traces of white rot activities.

3.6. Sample preparation

Sample collection stage was followed by:

- sieving of the different samples with a sieve of 2 mm diameter at the Biotechnology Centre laboratory of the University of Yaoundé I, followed by the measurement of the apparent densities
- Washing of oil palm roots with tap water was done at the pedology laboratory of the University of Yaoundé I. After being separated (the fine roots of the coarse roots), they were deposited in the Biotechnology Centre laboratory of analysis for the root density measurement.

Conclusion

Data collection at Bogso and Ngwéi allowed soil samples to be collected from the chronosequences of 13 oil palm farms and forest ecosystems. Observation, description, and harvesting of forest and oil palm plantation soils were useful in understanding their physical
and chemical composition after analysis of these samples in the laboratory. Socio-economic surveys have identified oil palm farms of different ages (4-8, 13-24 and ≥ 25 years). Most of them belong to small producers, whose limited financial means, do not allow the creation of large areas or the application of mineral fertilizers. Small sizes areas, on the other hand, are exploited on a very long term due to lack of means and give way to negative impacts on soil. This research on intercropping is aimed at demonstrating socio-economic benefits and its impact on soil fertility and ecosystem services. The ongoing laboratory processing results will come later in another report.

NB. This report has been written by
VOUNDI Eric (PhD student in geography)
NGO MAKAK Rose (MSc in geomatics)
ESSONO Damien Marie (PhD in forest ecology)

Under the supervision of PR Mesmin TCHINDJANG, OPAL academic partner.
Appendix 1: some elements of the research permit file

1. Coordonnées du demandeur:
   Applicant Personal Information
   Nom(s): GUILL AUVER
   Surname: THOMAS
   First name(s):
   Titre(s) (McMme/Mme/ProfDr) (barrer la mention inutile):
   Nationalité: SUISSE
   Date et lieu de naissance: 29.04.1983 Genève
   Diplôme le plus élevé: PhD in Agricultural Sciences
   Institution d'origine: EPFL - École Polytechnique Fédérale de Lausanne
   Institution Affiliation: EPFL - École Polytechnique Fédérale de Lausanne
   Mailing Address:

2. Titre du projet de recherche:
   Title of research project:

3. But de la recherche (si nécessaire indiquer autre (spécifier) (barrer la mention inutile):
   Purpose of research Ph.D. Master Bachelor degree(s) (specify) (barrer where applicable):

4. Objectifs de recherche:
   Determine the impact of the culture intercultural on the soybean production and productivity of the farmers in the study area.

5. Méthodologie de recherche (brève description):
   Research methodology (brief description):

Formateur de demande d’autorisation de recherche (MINRETI/CAMEROUN)
6. Régions du Cameroun où la recherche sera menée : (Choisir entre : Adamawa, Centre, Est, Extrême-Nord, Littoral, Nord, Nord-Ouest, Sud, Sud-Ouest, et Ouest). Regions in Cameroon where research will be conducted: (select from: Adamawa, Centre, East, Far North, Littoral, North, North-West, South, South-West, and West).

   Manchette / Sud-Ouest

7. Date du début de la recherche sur le territoire camerounais: 31.01.2018
   Proposed starting date of research:

   Proposed period of research:

9. (a) Source de financement (Nom et adresse) : Fonds national Suisse de la recherche
   Financial sponsor (Name & Address): Minex Internationa (P.O. Box CH-3001 Beine, Suisse)
   (b) Montant du financement: 56000 €
   Research budget:

10. Contact au Cameroun (Structure point focal intermédiaire) :
    Contact address in Cameroon (intermediary structure):

11. Références (Fournir les noms et adresses de votre homologue ou représentant du point focal de votre structure d’origine ou de votre projet au Cameroun pouvant répondre de vous) :
    References (provide names and addresses of your referee, or the local partner in Cameroon):

12. Nom(s) et institution(s) académique(s) d’étudiant(s) camerounais impliqué(s) à cette campagne :
    Name(s) and academic institution(s) of Cameroonian student(s) involved in this research:

13. Signature du demandeur : (précédé de l’engagement ci-après écrit de la main du demandeur :
   “Je m’engage à mettre à la disposition du MINRESI, les résultats et les innovations émanant de l’exploitation des échantillons prélevés au Cameroun conformément aux dispositions réglementaires de l’OMPI”)
   Signature of applicant: (First stipulate by personal handwriting the following commitment: “I promise to share the results and innovations obtained from samples collected in Cameroon, with the MINRESI, according to the WIPO’s regulations”)

   Je m’engage à mettre à la disposition du MINRESI, les résultats et les innovations émanant de l’exploitation des échantillons prélevés au Cameroun conformément aux dispositions réglementaires de l’OMPI
   I promise to share the results and innovations obtained from samples collected in Cameroon, with the MINRESI, according to the WIPO’s regulations.

   Signature et nom en dessous
   Signature and name below

   [Signature]
   Thomas Guillaume
CURRICULUM VITAE

POUR DEMANDE D'AUTORISATION DE RECHERCHE AU MINRESI
RELATED TO THE APPLICATION FOR RESEARCH AUTHORIZATION

1. Nom (Adnom/Arnier/De/Deux):
Guillaume

2. Nationalité:
Suisse

3. Date de naissance:
29.04.1983

4. Institution d'attaché (Nom et adresse complète):
École Polytechnique Fédérale de Lausanne - EPFL
Lausanne, Suisse

5. Adresse postale au lieu de résidence:
École Polytechnique Fédérale de Lausanne - EPFL
EPFL - EPFL - ECOS/SAIG - Génie Eau et Environnement
Lausanne, Suisse

6. Adresse électronique:
biologically@epfl.ch

7. Études supérieures:
Higher education:
(a) 1er Cycle/Undergraduate:
Diplôme (Degree):
Bachelor en Biologie
Année (Year):
2005
Université (University):
Université de Lausanne, Suisse
Pays (Country):
Suisse

(b) 2ème Cycle/Graduate:
Diplôme (Degree):
Master en Biogéosciences
Année (Year):
2007
Université (University):
Université de Neuchâtel
Pays (Country):
Suisse

(c) 3ème Cycle/Postgraduate:
Diplôme (Degree):
PhD en Science de l'Agriculture
Année (Year):
2015
Université (University):
Université de Genève
Pays (Country):
Suisse

8. Profession actuelle/ Position held (current position):
Post-doctorant en biogéochimie de l'eau
Institution:
EPFL - WSL
DEMANDE D'AUTORISATION DE RECHERCHE
APPLICATION FOR RESEARCH AUTORISATION
(A remplir individuellement par chaque membre de l'équipe le cas échéant)
(To be filled by each member of the team if applicable)

1. Coordonnées du demandeur :
   Applicant Personal Information
   Nom(s): TANGANG P
   Surnom(s):
   Prénom(s):
   Titre (Dépôt/Membre Prof Doc) (Barier la mention inutile):
   Nationalité:
   Date et lieu de Naissance :
   Diplôme le plus élevé:
   HABILITATION À DIRIGER DES RECHERCHES (HDR)
   Institution d'Origine:
   Adresse postale :
   Mailing Address:

   Pays d'origine :
   Country of origin:

   Adresse Electorale :
   Email address:

2. Titre du projet de recherche :
   Title of research project:
   Impact of oil palm on cropping on field facility

3. But de la recherche PhD/Master/Licence/autre (spécifier) (Barier la mention inutile):
   Purposes of research PhD/Master/Bachelor degree/others (specify) (Delete where applicable):
   Publication Scientifique

4. Objectifs de recherche :
   Research objectives:
   L'impact de la culture de l'oso sur la productivité et les rendements des sols,

5. Méthodologie de recherche (brève description) :
   Research methodology (short description):
   Études de l'impact de la culture de l'oso sur la production et les rendements des sols,
   Interviews.

Formulaire de demande d'Autorisation de Recherche, MINRESI/CAMEROUN

   Regions in Cameroon where research will be conducted: (select from: Adamawa, Centre, East, Far North, Littoral, North, North-West, South, South-West, and West):

   Centre, Littoral, Sud-Ouest.

7. Date du début de la recherche sur le territoire camerounais: Février 2018

   Proposed starting date of research:

8. Période de recherche sollicitée: 12 mois

   Proposed period of research:

9. (a) Source de financement (Nom et adresse):

   Financial source (Name & Address):

   PROJET OPAL

   (b) Montant du financement: 56 000 €

   Research budget:

10. Contact au Cameroun (Structure point focal intermédiaire):

    Contact address in Cameroon (Intermediate structure):

11. Références (Fournir les noms et adresse de votre homologue ou représentant du point focal de votre structure d’origine ou de votre projet au Cameroun pouvant répondre de vous):

    References (provide names and addresses of your referee, or the local partner in Cameroon):

12. Nom(s) et Institution(s) académique(s) d’étudiant(s) camerounais impliqué(s) à cette campagne:

    Name(s) and academic institution(s) of Cameroonian student(s) involved in this research:

    Département de Géographie (FASH) Université Yaoundé 1 (1)
    Département des Sciences de la Terre (FAS) Université Yaoundé 2 (2)
    ABATONUK DAEMON LOMA et CHENTONOKA JASMIN (3)
    Massemba MBA DONATI (4)

13. Signature du demandeur : (précédé de l’engagement ci-après écrit de la main du demandeur: "Je m’engage à mettre à la disposition du MINRESI, les résultats et les innovations émanant de l’exploitation des échantillons prélevés au Cameroun conformément aux dispositions réglementaires de l’OMPI")

    Signature of applicant: (First stipulated by personal handwriting the following commitment: "I promise to share the results and innovations obtained from samples collected in Cameroon, with the MINRESI, according to the WIPO’s regulations")

    Je m’engage à mettre à la disposition du MINRESI les résultats et les innovations émanant de l’exploitation des échantillons prélevés au Cameroun conformément aux dispositions réglementaires.

    Signature et nom en dessous
    Signature and name below

    [Signature]

    [Signature]
CURRICULUM VITAE

POUR DEMANDE D’AUTORISATION DE RECHERCHE AU MINRESI
RELATED TO THE APPLICATION FOR RESEARCH AUTHORIZATION

1. Nom (First name): MESSING MESSIM 
   Prenom (M/Mr/Mme/Md/Prof): MESSIM

2. Nationalité : CAMEROON Pays d’origine : CAMEROON
   Citizenship: Country of origin:

3. Date de naissance : 26/01/1967 Lieu de naissance : NOUVELLE DOUALA
   Date of Birth: Place of Birth:

4. Institution d’attache (Nom et adresse complète) : FALSIK, Yaoundé BP 755 Yaoundé
   Institution affiliation (Name and full address):

5. Adresse postale au lieu de résidence : BP 3046 Yaoundé
   Mailing address (residence):

6. Adresse électronique : mcinzy@yahoo.fr
   E-mail address:

7. Études supérieures :
   Higher education:
   (a) 1er Cycle/Undergraduate: Diplôme (Degree): Licence en géographie physique
      Année (Year): 1984 
      Specialité (Major field): Géographie physique opt. économie
      Université (University): Yaoundé
      Pays (Country): Cameroun

   (b) 2éme Cycle/Graduate: Diplôme (Degree): DEA en géographie physique
      Année (Year): 1985 
      Specialité (Major field): Géographie physique
      Université (University): Yaoundé
      Pays (Country): Cameroun

   (c) 3éme Cycle/Postgraduate: Diplôme (Degree): Doctorat
      Année (Year): 1996 
      Specialité (Major field): Géographie physique
      Université (University): Yaoundé
      Pays (Country): Cameroun

8. Profession actuelle/ Position held [with current position]
   Poste de travail/Position: Doctorat
   Anciennement au poste de professeur à l’université de Yaoundé
   Institution: Université de Yaoundé

21
Siège social : Yaoundé Cameroun, BP. 30464 Yaoundé. Courriel : gmemasso@yahoo.fr gmemasso@gmail.com Tél. : (237) 699 85 59 26 / (237) 675 77 32 70

REPUBLIC OF CAMEROON
Peace – Work – Fatherland
MINISTRY OF SCIENTIFIC RESEARCH AND INNOVATION

LETTRE D’ENGAGEMENT DE L’HOMOLOGUE - N° LEH /MINRESI/BOO/COO/C10/ (En trois exemplaires)

Je soussigné : Tchimbaso G. Mesmin ................. Profession : Haute au Conseil en FALSH ...
Tél. : G99-855-935-142-354-1111 ....... email : ....itahih@gmail.com ........................................
Institution au Cameroun ayant mandaté l’homologue : FALSH ... Université ... YOUNGO ...

- Adresse : B.P. 765 ... Yaoundé ...
- Type de relation entre l’institution et la structure étrangère d’attache du demandeur ou le demandeur lui-même (contrat, partenariat, bourse, ...) partenariat ........................................ (Joindre copie au dossier)
- Thème de Recherche de l’équipe de recherche ou du chercheur venant de l’étranger, ou sponsorisé par la structure étrangère .......................................................... (Joindre copie au dossier)
- Site(s) / Région(s) de la Recherche au Cameroun .......................................................... (Joindre copie au dossier)

- Durée de la présente phase des travaux de Recherche au Cameroun ...........................................

M’engage à :

- représenter le Gouvernement du Cameroun au sein du groupe de recherche conduit par : THOMAS GUILLAUME ............................................ Chercheur principal ou Chef de l’équipe,
- veiller à ce que ces travaux de recherche soient menés sur le(s) site(s) sollicité(s) sur le territoire Camerounais, dans le strict respect des lois et règlements en vigueur ;
- veiller à ce qu’un rapport d’activités menées sur le terrain soit produit immédiatement au terme de la campagne dans chaque Région et remis au Chef du Centre Régional de Recherche et d’Innovation ;
- veiller à ce que par le terme de la durée de l’autorisation, cinq copies du rapport scientifique et technique des travaux qui font l’objet de l’autorisation de recherche concernée, soient produits et déposés sur décharge auprès des services compétents (Division des Politiques Scientifiques et de la Planification DPSP) du Ministère en charge de la Recherche Scientifique du Cameroun ;
- travailler effectivement en qualité d’homologue avec l’/les étudiant(s) des universités camerounaises impliquées dans ces travaux, auprès du (des) chercheur(s) étranger(s) ci-dessous :

1- Messeh Mba B L
2- Obangou Bawanda E
3- Abasombe Guy Donald

- à répondre devant les tribunaux compétents à toute violation des lois et règlements du Cameroun.

VISA ET AVIS MOTIVÉ DE L’INSTITUT DE L’HOMOLOGUE

Yaoundé, le ____________

LE MINRESI

Le Souscripteur (Homologue)

Lucien Ayissi

Professeur

* Préciser la boîte postale, le site Internet du Cameroun, le numéro de téléphone, fax, email.
Appendix 2 : Questionnaire on intercropping

OPAL INDIVIDUAL QUESTIONNAIRE
IMPACTS OF OIL PALM INTERCROPPING ON SOIL FERTILITY, INCOME AND PRODUCTIVITY

This questionnaire has an exclusively scientific purpose. Information collected in this survey is strictly confidential according to the Law n° 91/023 of December 16, 1991 on censuses and statistical surveys in Cameroon. Thanks you for your contribution and your understanding.

GENERAL DATA

IDENTIFICATION AND LOCATION OF THE OPERATING UNIT

REGION SURVEYED _____________________________________________
DIVISION _____________________________________________________
DISTRICT/COUNCIL ____________________________________________
CANTON/GROUP ______________________________________________
VILLAGE _______________________________________________________
ORDER N° THE SURVEY _________________________________________

INVESTIGATION AND CONTROL REPORT

INVESTIGATOR _________________________________________________
SURVEY DATE ________________________________________________
START TIME OF THE INTERVIEW __________________________________
TIME END OF THE INTERVIEW ____________________________________
DATA COLLECTION SUPERVISOR ________________________________
DATE OF CONTROL ___________________________________________

DATA ENTRY REPORT

DATA ENTRY AGENT ____________________________________________
DATA ENTRY DATE _____________________________________________
DATA ENTRY SUPERVISOR :
_________________________________________________________________
### Section 1: Operator identification

<table>
<thead>
<tr>
<th>101</th>
<th>Name and surnames</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>102</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>103</th>
<th>Region of origin</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>104</th>
<th>How old are you?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-</td>
<td>Under de 25 years</td>
</tr>
<tr>
<td>b-</td>
<td>25 - 35</td>
</tr>
<tr>
<td>c-</td>
<td>36 - 45</td>
</tr>
<tr>
<td>d-</td>
<td>46 - 55</td>
</tr>
<tr>
<td>e-</td>
<td>56 - 65</td>
</tr>
<tr>
<td>f-</td>
<td>More than 65 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>105</th>
<th>What is your highest level of education?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary</td>
</tr>
<tr>
<td>2</td>
<td>Secondary</td>
</tr>
<tr>
<td>3</td>
<td>Higher</td>
</tr>
<tr>
<td>4</td>
<td>No instruction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>106</th>
<th>Do you own this oil palm plantation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>107</th>
<th>In which locality does the owner (town / village) live?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Section 2: Characteristics of palm plantations

<table>
<thead>
<tr>
<th>Palm plantation</th>
<th>Year of creation</th>
<th>Area</th>
<th>cultivated varieties</th>
<th>Space between palm trees</th>
<th>Year of planting</th>
<th>1st harvest year</th>
<th>Number of workers</th>
<th>Workforce origin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Creation of the palm plantation**

<table>
<thead>
<tr>
<th>202</th>
<th>How did you finance the creation of your palm plantation?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Personal funds</td>
</tr>
<tr>
<td></td>
<td>2 Bank loan</td>
</tr>
<tr>
<td></td>
<td>3 Private loans (tontines, individuals)</td>
</tr>
<tr>
<td></td>
<td>4 Government allowance</td>
</tr>
<tr>
<td></td>
<td>5 Project Donations</td>
</tr>
<tr>
<td></td>
<td>6 Others</td>
</tr>
</tbody>
</table>

### Section 3: Intercropping

301. Do you practice intercropping in your palm plantation? Yes…… No….
Why ?...................................................................................................................................................

302. What types of crops do you use for intercropping in your palm plantation?

<table>
<thead>
<tr>
<th>Corn</th>
<th>Peanut</th>
<th>Cassava</th>
<th>Pistachio</th>
<th>Macabo</th>
<th>Plantain</th>
<th>Bean</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>2nd year</td>
<td>3rd year</td>
<td>4th year</td>
<td>5th year</td>
<td>6th year</td>
<td>1st year</td>
<td>2nd year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

303. Do you have regular spacing between the palm and intercropping? Yes … No…
If yes Which interval ?...........................................................

304. Do you have any association of crops in your plantation during intercropping? If yes, specify?

<table>
<thead>
<tr>
<th>Association of crops</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
<th>6th year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Advantages and disadvantages of intercropping

<table>
<thead>
<tr>
<th>305</th>
<th>What are the advantages of intercropping?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Food</td>
</tr>
<tr>
<td></td>
<td>2 Financial income</td>
</tr>
<tr>
<td></td>
<td>3 Weed protection</td>
</tr>
<tr>
<td></td>
<td>4 Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>306</th>
<th>What are the disadvantages of intercropping?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Decrease soil fertility</td>
</tr>
<tr>
<td></td>
<td>2 Decrease in palm oil yields</td>
</tr>
<tr>
<td></td>
<td>3 Disturbance of palm growth</td>
</tr>
<tr>
<td></td>
<td>4 Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>307</th>
<th>What would intercropping bring to your plantation?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Improve soil fertility</td>
</tr>
<tr>
<td></td>
<td>2 Decrease soil fertility</td>
</tr>
<tr>
<td></td>
<td>3 I do not know</td>
</tr>
</tbody>
</table>

308. On a scale of 1 to 5 what score will you give to intercropping in terms of

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

309. What year did you stop with intercropping in your palm plantation? ..........

Section 4 : Fertilizers

401. Do you use fertilizers? Yes ? No ?

<table>
<thead>
<tr>
<th>Types of fertilizer</th>
<th>Cost</th>
<th>%</th>
<th>Frequency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1st year 2nd year 3rd year 4th year 5th year 6th year 7th year</td>
</tr>
<tr>
<td>Chemical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

402. How much fertilizer do you use in your plantation at different stages of growth? Give a rough estimate in kg / year.

<table>
<thead>
<tr>
<th>Fertilizer quantity</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
<th>6-10 years</th>
<th>11-15 years</th>
<th>16-20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Section 5 : Production and income

Intercropping

501. What production do you get from intercropping ? Specify the quantity (bag, stem, bucket)

<table>
<thead>
<tr>
<th></th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Siège social : Yaoundé Cameroun, BP. 30464 Yaoundé. Courriel : gmemasso@yahoo.fr
gmemasso@gmail.com  Tél. : (237) 699 85 59 26 / (237) 675 77 32 70

<table>
<thead>
<tr>
<th>Peanut</th>
<th>Cassava</th>
<th>Pistachio</th>
<th>Macabo</th>
<th>Plantain</th>
<th>Bean</th>
<th>Others</th>
</tr>
</thead>
</table>

502. What benefits do you get from intercropping in terms of cash income? Specify in value (average price of a bag, stem or bucket).

<table>
<thead>
<tr>
<th></th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanut</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pistachio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macabo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plantain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Annual total**

503. What are you using this financial profit for??
   A. Purchase of fertilizers
   B. Payment of farm workers
   C. Family needs (children’s pensions, welding, self-consumption, etc.)

**Palm oil**

504. With what type of press do you produce oil?

<table>
<thead>
<tr>
<th>Crushed (Feet, Mortar)</th>
<th>Hand press</th>
<th>Motorized mill</th>
<th>Semi industrial</th>
<th>Industrial mill</th>
</tr>
</thead>
</table>

505. How much oil do you produce per year from the first year of harvest? Litres, tons?

<table>
<thead>
<tr>
<th>Oil quantity</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
<th>6-10 years</th>
<th>11-15 years</th>
<th>16-20 years</th>
</tr>
</thead>
</table>

506. What income do you get from the oil palm every year? Annual estimate

507. Do the profits from the exploitation of your palm grove and the intercropping allow you to cover your needs?
   1 Yes
   2 No

508. Are the exploitation of the palm grove and intercropping your only sources of income?
   1 Yes
   2 No

509. If yes, what other income-generating activities do you practice?
   1........................
   2........................
   3........................
Appendix 3: Financial report.

Financial Report of the Academic Partner (04 December-28 February)

**December**

**DSA for fieldwork**

<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit Cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>07-11 /12/ 2017</td>
<td>4</td>
<td>39357</td>
<td>60</td>
<td>157 428</td>
<td>240</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>07-14 /12/2017</td>
<td>7</td>
<td>26238</td>
<td>40</td>
<td>183 666</td>
<td>280</td>
</tr>
<tr>
<td>Abasombe Guy Donald</td>
<td>07-14 /12/2017</td>
<td>7</td>
<td>26238</td>
<td>40</td>
<td>183 666</td>
<td>280</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>524 760</strong></td>
<td><strong>800</strong></td>
</tr>
</tbody>
</table>

**DSA for accommodation (December)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit Cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>07-11 /12/ 2017</td>
<td>4</td>
<td>26238</td>
<td>40</td>
<td>104 952</td>
<td>160</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>07-14 /12/2017</td>
<td>7</td>
<td>15087</td>
<td>23</td>
<td>105 609</td>
<td>161</td>
</tr>
<tr>
<td>Abasombe Guy Donald</td>
<td>07-14 /12/2017</td>
<td>7</td>
<td>15087</td>
<td>23</td>
<td>105 609</td>
<td>161</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>316 170</strong></td>
<td><strong>482</strong></td>
</tr>
</tbody>
</table>

**Recap December 2017**

XAF : 524 760 + 316 170 = 840 930

Euros : 800 + 482 = 1282
## January 2018
### DSA for fieldwork

<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit Cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>15-18 /01/2018</td>
<td>4</td>
<td>39357</td>
<td>60</td>
<td>157 428</td>
<td>240</td>
</tr>
<tr>
<td>Essono Damien Marie</td>
<td>15-20 /01/2018 and 25-27/01/2018</td>
<td>6 + 3 (9)</td>
<td>26238</td>
<td>40</td>
<td>157 428</td>
<td>240</td>
</tr>
<tr>
<td>Messende Mba Benoit Landry</td>
<td>15-18 /01/2018</td>
<td>4</td>
<td>26238</td>
<td>40</td>
<td>104 952</td>
<td>160</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>25-27/01/2018</td>
<td>3</td>
<td>26238</td>
<td>40</td>
<td>78 714</td>
<td>120</td>
</tr>
<tr>
<td>Voundi Éric</td>
<td>25-27/01/2018</td>
<td>3</td>
<td>26238</td>
<td>40</td>
<td>78 714</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>577 236</strong></td>
<td><strong>880</strong></td>
</tr>
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</table>

### DSA for accommodation

<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit Cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>15-18 /01/2018</td>
<td>4</td>
<td>26238</td>
<td>40</td>
<td>104 952</td>
<td>160</td>
</tr>
<tr>
<td>Essono Damien Marie</td>
<td>15-20 /01/2018</td>
<td>6</td>
<td>15087</td>
<td>23</td>
<td>90 522</td>
<td>138</td>
</tr>
<tr>
<td>Messende Mba Benoit Landry</td>
<td>15-18 /01/2018</td>
<td>4</td>
<td>15087</td>
<td>23</td>
<td>60 348</td>
<td>92</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>25-27/01/2018</td>
<td>3</td>
<td>15087</td>
<td>23</td>
<td>45 261</td>
<td>69</td>
</tr>
<tr>
<td>Voundi Éric</td>
<td>25-27/01/2018</td>
<td>3</td>
<td>15087</td>
<td>23</td>
<td>45 261</td>
<td>69</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>346 344</strong></td>
<td><strong>528</strong></td>
</tr>
</tbody>
</table>

### Recap January 2018

- XAF: $577,236 + 346,344 = 923,580$
- Euros: $880 + 528 = 1,408$
February 2018
DSA for fieldwork

<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>20-23/02/2018</td>
<td>3 (Douala meeting)</td>
<td>39357</td>
<td>60</td>
<td>118 071</td>
<td>180</td>
</tr>
<tr>
<td>Essono Damien Marie</td>
<td>29/01 au 02/02/2018 and 20-24/02/2018</td>
<td>6 + 5 (11)</td>
<td>26238</td>
<td>40</td>
<td>288 618</td>
<td>440</td>
</tr>
<tr>
<td>Messende Mba Benoit Landry</td>
<td>29/01 au 02/02/2018</td>
<td>6</td>
<td>26238</td>
<td>40</td>
<td>157 428</td>
<td>240</td>
</tr>
<tr>
<td>Ongbibou Bakanda Edith</td>
<td>29/01 au 02/02/2018</td>
<td>6</td>
<td>26238</td>
<td>40</td>
<td>157 428</td>
<td>240</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>20-24/02/2018</td>
<td>5</td>
<td>26238</td>
<td>40</td>
<td>131 190</td>
<td>200</td>
</tr>
<tr>
<td>Voundi Eric</td>
<td>20-24/02/2018</td>
<td>5</td>
<td>26238</td>
<td>40</td>
<td>131 190</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>983 925</strong></td>
<td><strong>1500</strong></td>
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DSA for accommodation

<table>
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<tr>
<th>Name</th>
<th>Period</th>
<th>Duration (days)</th>
<th>Unit cost XAF</th>
<th>Unit cost €</th>
<th>Total cost XAF</th>
<th>Total cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchindjang Mesmin</td>
<td>20-23/02/2018</td>
<td>3 (Douala meeting)</td>
<td>26238</td>
<td>40</td>
<td>78 714</td>
<td>120</td>
</tr>
<tr>
<td>Essono Damien Marie</td>
<td>29/01 au 02/02/2018 and 20-24/02/2018</td>
<td>6 + 5 (11)</td>
<td>15087</td>
<td>23</td>
<td>165 957</td>
<td>253</td>
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<tr>
<td>Messende Mba Benoit Landry</td>
<td>29/01 au 02/02/2018</td>
<td>6</td>
<td>15087</td>
<td>23</td>
<td>90 522</td>
<td>138</td>
</tr>
<tr>
<td>Ongbibou Bakanda Edith</td>
<td>29/01 au 02/02/2018</td>
<td>6</td>
<td>15087</td>
<td>23</td>
<td>90 522</td>
<td>138</td>
</tr>
<tr>
<td>Ngo Makak Rose</td>
<td>20-24/02/2018</td>
<td>5</td>
<td>15087</td>
<td>23</td>
<td>75 435</td>
<td>115</td>
</tr>
<tr>
<td>Voundi Eric</td>
<td>20-24/02/2018</td>
<td>5</td>
<td>15087</td>
<td>23</td>
<td>75 435</td>
<td>115</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36 days</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>576 585</strong></td>
<td><strong>879</strong></td>
</tr>
</tbody>
</table>

Recap February 2018
XAF : 983 925 + 576 585 = **1 560 510**
Euros : 1500 + 879 = **2379**
### Other expenses

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Unit cost</th>
<th>Unit Cost</th>
<th>Total cost XAF</th>
<th>Total cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocopy of questionnaire</td>
<td>440</td>
<td>25</td>
<td></td>
<td>11 000</td>
<td>17</td>
</tr>
<tr>
<td>Field guide</td>
<td>7</td>
<td>25 000</td>
<td>38,11</td>
<td>175 000</td>
<td>267</td>
</tr>
<tr>
<td>Mask entry</td>
<td>Flat rate</td>
<td>-</td>
<td>-</td>
<td>200 000</td>
<td>305</td>
</tr>
<tr>
<td>Procurement of fieldwork material</td>
<td>Flat rate</td>
<td>-</td>
<td>-</td>
<td>100 000</td>
<td>152</td>
</tr>
<tr>
<td>Sample conditioning and pre treatment at soils microbiology laboratory</td>
<td>Flat rate</td>
<td>-</td>
<td>-</td>
<td>200 000</td>
<td>305</td>
</tr>
<tr>
<td>Sample treatment at IITA</td>
<td>74</td>
<td>27 500</td>
<td>42</td>
<td>2 035 000</td>
<td>3108</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>2 721 000</strong></td>
<td><strong>4154</strong></td>
</tr>
</tbody>
</table>

### Final Recap

<table>
<thead>
<tr>
<th>Month /item</th>
<th>Total cost XAF</th>
<th>Total cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2017</td>
<td>840 930</td>
<td>1282</td>
</tr>
<tr>
<td>January 2018</td>
<td>923 580</td>
<td>1408</td>
</tr>
<tr>
<td>February 2018</td>
<td>1 560 510</td>
<td>2379</td>
</tr>
<tr>
<td>Other expenses</td>
<td>2 721 000</td>
<td>4154</td>
</tr>
<tr>
<td>Monthly rate academic partner (December 2017)</td>
<td>1 311 914</td>
<td>2000</td>
</tr>
<tr>
<td>Monthly rate academic partner (January 2018)</td>
<td>1 311 914</td>
<td>2000</td>
</tr>
<tr>
<td>Monthly rate academic partner (February 2018)</td>
<td>1 311 914</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9 981 762</td>
<td>15 223</td>
</tr>
</tbody>
</table>

**NB**: Monthly rate academic partner is not provided for January and February months.

Yaoundé 28 February 2018
Appendix 4 : Mission Orders.

ORDRE DE MISSION /MISSION ORDER
N°021/12/17

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018

M. ABASOMBE Guy Donald se rendra dans le Nyong & Kellé (Eséka, Makak, Matomb Ngog Mapubi, Biyouha, Botmakak) du 07 au 14 décembre 2017.

Mr ABASOMBE Guy Donald will proceed to the Nyong & Kellé Division (Eséka, Makak, Matomb, Ngog Mapubi, Biyouha, Botmakak) from 07 to 14th December 2017.

Fait à Yaoundé le 02 décembre 2017
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°022/12/17

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

*Impacts of oil palm intercropping on soil fertility, incomes and productivity.*

**Projet OPAL /OPAL Project**

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*As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018*

Mme NGO MAKAK Rose se rendra dans le Nyong & Kellé (Eséka, Makak, Matomb Ngog Mapubi, Biyouha, Botmakak) du 07 au 14 décembre 2017.

*Mrs NGO MAKAK Rose will proceed to the Nyong & Kellé Division (Eséka, Makak, Matomb, Ngog Mapubi, Biyouha, Botmakak) from 07 to 14th December 2017.*

Fait à Yaoundé le 02 décembre 2017

Le Directeur du GMEM
ORDRE DE MISSION / MISSION ORDER
N°005/01/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL / OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018

M ESSONO Damien Marie se rendra dans les localités de Bogso, Ngwéi, Limbe et Buea du 15 au 20 janvier 2018.

Mr ESSONO Damien Marie will proceed to the Bogso, Ngwéi, Limbe and Buea villages from 15 to 20 January 2018.

Fait à Yaoundé le 12 janvier 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°006/01/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018


Mr MESSENDE MBA Benoit Landry will proceed to the Bogso, Ngwéi, Limbe and Buea villages from 15 to 18 January 2018.

Fait à Yaoundé le 12 janvier 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°007/01/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

*Impacts of oil palm intercropping on soil fertility, incomes and productivity.*

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

M ESSONO Damien Marie se rendra dans la localité de Bogso dans le Nyong et Kellé du 25 au 27 janvier 2018.

Mr ESSONO Damien Marie will proceed to the Bogso village in the Nyong et Kelle from 25 to 27 January 2018.

Fait à Yaoundé le 23 janvier 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°008/01/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

M VOUNDI Eric se rendra dans la localité de Bogso dans le Nyong et Kellé du 25 au 27 janvier 2018.

Mr VOUNDI Eric will proceed to the Bogso village in the Nyong et Kelle from 25 to 27 January 2018.

Fait à Yaoundé le 23 janvier 2018
Le Directeur du GMEM

Prof. Dr. FchindjangMesmin
Géographe-Environnementaliste
Université de Yaoundé I
**ORDRE DE MISSION /MISSION ORDER**

N°009/01/18

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

Mrs NGO MAKAK Rose will proceed to the Bogso village in the Nyong et Kelle from 25 to 27 January 2018.

Fait à Yaoundé le 23 janvier 2018

Le Directeur du GMEM
ORDRE DE MISSION / MISSION ORDER
N°010/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité
des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL / OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le
GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé
et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between
the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and
Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018

M ESSONO Damien Marie se rendra dans la localité de Bogso dans le Nyong et Kellé du
29 janvier au 02 février 2018.

Mr ESSONO Damien Marie will proceed to the Bogso village in the Nyong et Kelle from 29
January to 2nd February 2018.

Fait à Yaoundé le 27 janvier 2018
Le Directeur du GMEM

Prof. Dr. Tchindjang Mesmin
Géographe-Environnementaliste
Université de Yaoundé I
ORDRE DE MISSION /MISSION ORDER
N°011/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

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As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018

M MESSENDE MBA Benoit Landry se rendra dans la localité de Bogso dans le Nyong et Kellé du 29 janvier au 02 février 2018.

Mr MESSENDE MBA Benoit Landry will proceed to the Bogso village in the Nyong et Kelle from 29 January to 2nd February 2018.

Fait à Yaoundé le 27 janvier 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°012/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

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As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

Mlle ONGBIBOU BAKANDA Edith se rendra dans la localité de Bogso dans le Nyong et Kellé du 29 janvier au 02 février 2018.

Mrs ONGBIBOU BAKANDA Edith will proceed to the Bogso village in the Nyong et Kelle from 29 January to 2nd February 2018.

Fait à Yaoundé le 27 janvier 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°013/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

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As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

M VOUNDI Eric se rendra dans les villages de l’arrondissement de Ngwéi (Makondo, Seppe, Njockloumbe, Makek etc.) dans le Sanaga Maritime du 20 au 24 février 2018.

Mr VOUNDI Eric will proceed to the villages of the Ngwei district (Makondo, Seppe, Njockloumbe, Makek etc.) in the Sanaga Maritime Division from 20 to 24 February 2018.

Fait à Yaoundé le 15 février 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°014/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Impacts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

As part of the implementation of the OPAL project and resulting from the agreement between the WWF and the GMEM, field data collection surveys will take place in Nyong Kellé and Sanaga Maritime administrative Divisions between 4 December 2017 and 28 February 2018.

Mme NGO MAKAK Rose se rendra dans les villages de l’arrondissement de Ngwéi (Makondo, Seppe, Njockloumbe, Makek etc.) dans le Sanaga Maritime du 20 au 24 février 2018.

Mrs NGO MAKAK Rose will proceed to the villages of the Ngwei district (Makondo, Seppe, Njockloumbe, Makek etc.) in the Sanaga Maritime Division from 20 to 24 February 2018.

Fait à Yaoundé le 15 février 2018
Le Directeur du GMEM
ORDRE DE MISSION /MISSION ORDER
N°015/02/18

Impacts de la culture intercalaire dans les plantations de palmier à huile sur la fertilité des sols, la productivité de la plantation et les revenus.

Erracts of oil palm intercropping on soil fertility, incomes and productivity.

Projet OPAL /OPAL Project

Dans le cadre de la mise en œuvre du projet OPAL et issu de la convention entre le WWF et le GMEM, des enquêtes de collectes de données de terrain se dérouleront dans le Nyong Kellé et la Sanaga Maritime entre le 4 décembre 2017 et le 28 février 2018.

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M ESSONO Damien Marie se rendra dans les villages de l’arrondissement de Ngwéi (Makondo, Seppe, Njockloumbe, Makek etc.) dans le Sanaga Maritime du 20 au 24 février 2018.

Mr ESSONO Damien Marie will proceed to the villages of the Ngwei district (Makondo, Seppe, Njockloumbe, Makek etc.) in the Sanaga Maritime Division from 20 to 24 February 2018.

Fait à Yaoundé le 15 février 2018
Le Directeur du GMEM