



## **The impacts of artisanal gold mining on local livelihoods and the environment in the forested areas of Cameroon**

Kevin N. Funoh



Working Paper 150

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# List of abbreviations

AIDS	acquired immune deficiency syndrome
CAPAM	Small-scale Mining Support Framework Unit
CIG	Common Initiative Group
CIMEC	Cameroon International Mining Conference
FMP	forest management plan
FMU	forest management units
FSLC	First School Leaving Certificate
GDP	gross domestic product
GEF	Global Environment Facility
GESP	Growth and Employment Strategy Paper
GPS	geographical positioning system
HIV	human immunodeficiency virus
MINFI	Ministry of Finance
MINEPDED	Ministry of Environment, Nature Protection and Sustainable Development
MINFOF	Ministry of Forests and Wildlife
MINMIDT	Ministry of Mines Industries and Technological Development
NMFM	Ngoyla-Mintom Forest Massif
NPFE	non-permanent forest estate
NTFP	non-timber forest product
PFE	permanent forest estate
SPSS	standard package for social sciences
TNS	Tri-National de la Sangha
TRIDOM	Tri-Nationale Dja-Odzala-Minkébé
UNESCO	United Nations Educational Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VAT	value added tax
WB	World Bank
WWF	World Wide Fund for Nature
XAF	Central Africa (CFA) Francs

# Glossary

## Artisanal and small-scale mining

Artisanal and small-scale mining, as the term is used in most parts of the world, has also been defined differently and so has no standard definition.

According to the Cameroonian Mining Code of 2001, Article 2, artisanal mining involves all exploitations aimed at extracting and concentrating minerals using manual methods and procedures with the use of little or no mechanization.

According to the United Nations, “small-scale mining is any single mining unit operation having an annual unit of unprocessed materials of 50,000 tonnes or less as measured at the entrance of the mine.”

In Ghana, small-scale (gold) mining is defined as, “Mining by any method not involving substantial expenditure by an individual or group of persons not exceeding nine in number or by co-operatives society made up to ten persons or more.”

In this study the term artisanal mining is defined as mining with the use of manual methods and procedures with little or no mechanization, as stipulated by the mining code.

## Livelihoods

According to Chambers (1988), a livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. These basic needs include: water, food, shelter, medicine and clothing.

According to the Oxford Dictionary of English, livelihood is defined as a set of activities, involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire the above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity.

## Lode mining

A lode is any mineral deposit that is embedded in hard rock. They are often called veins when the ore is between two layers of rock. These deposits also fill fissures or cracks in rock formations. The mining of such deposits is called lode mining.

## Alluvial mining

Alluvial mining is mining done in a stream or riverbed. Alluvial mineral deposits are essentially primary lode deposits broken down by weathering and erosion upstream, transported by gravity and water movement over many millennia of geological time, and deposited.



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# Executive summary

Mining is an activity that employs many people in rural areas because the barriers to entry are minimal, with low technology, capital and limited specialized skills needed. Miners can earn higher incomes in mining than through other traditional activities. Artisanal mining can contribute to poverty alleviation and provides many opportunities. It is an activity associated with many negative social impacts. Miners are exposed to chemical contaminants, unsanitary conditions, prostitution, alcoholism and drug-taking. Women and children are generally the most affected by these hazards.

Artisanal mining is associated with a number of environmental impacts, which are deforestation and land degradation, open pits which pose animal traps and health hazards, and mercury pollution, dust and noise pollution. A large proportion of artisanal miners are unaware of the laws governing mining activities and the environment.

The main objective of this study is to understand how artisanal gold mining in the Ngoyla-Mintom Forest Massif (NMF) affects local livelihoods and the environment. Key recommendations for addressing artisanal mining activities in the NMF and options for sustainable management of mineral resources in forest milieus are proposed.

The methodology for the research consisted of a literature review, visits to eight mining camps on the periphery of Mintom, interviews with 95 miners, focus group discussions with actors involved in activities related to gold mining, and stakeholder consultations. Data collected was analyzed in three phases: data entry, analysis and correction. Data was entered into Excel and transferred into SPSS Program Version 16.0 for analysis.

A total of 84% of miners surveyed were of Cameroonian nationality and 16% were from other African countries. Cameroonian miners were from 13 different ethnic groups from seven regions of the country. Only 3.2% of miners were women. The mining population in NMF is continuously growing, with more and more people coming from different regions and countries. Mining attracts more youths, with over 80% of miners being younger than 35. Just 10% of miners had not received any formal education and 29% had just primary education. Miners earn a minimum of XAF

80,000 (US\$ 160) which is close to three times the average wage of a Cameroonian (XAF 28,216 or US\$ 56) and a maximum of XAF 800,000 (US\$ 1600) a month. The basic needs met through mining income include: food, health, clothing, shelter and education. Mining is the best choice for artisanal miners since there is no restriction to entry, no taxes paid and revenue is immediate, compared to other activities such as agriculture. The economic benefits of artisanal gold mining in the NMF are quite considerable, with the proliferation of many business activities both inside mining camps and in surrounding villages.

Mining leads to the creation of many associated activities such as portering, catering and the intensification of hunting, collection of NTFPs, and fishing, among others. About 70% of the miners confirmed that mining was their principal activity. The other 30% reported that they carried out mining along with other activities. As many as 75.8% of miners interviewed had spent less than five years in mining, with the oldest miner having spent 20 years mining.

Mining has negative social impacts on the population as it is associated with activities such as prostitution that leads to the spread of sexually transmitted diseases (STDs) including HIV/AIDS (Hentschel et al. 2002). Many children drop out of school to take up mining, with children as young as 15 found mining. Hygienic conditions inside mining camps are deplorable and lack of clean drinking water causes waterborne diseases in mining populations. Mining is a very risky business because miners mine through trial and error.

Mining was observed to have negative impacts on the environment by a minority of miners. The majority (75%) of miners interviewed reported that mining did not have any negative impacts on the environment and the remaining 25% cited impacts such as open mines and deforestation. Observed impacts on the environment listed were the destruction of fragile forest ecosystems such as forest swamps, diversion, sedimentation and pollution of river courses, and soil destruction. Miners practice poaching and hunt protected species. Illegal logging activities develop in the forest when there are mining activities present. The environmental impacts of artisanal gold mining and the secondary activities it generates in the NMF are still on a small-scale, but will have adverse effects if mining activities continue to grow at the present rate.

# Key recommendations

1. The government and its partners should make efforts to harmonize forestry and mining laws to avoid conflicts of interest. This will lead to sustainable management of both forest and mineral resources.
2. Put in place follow-ups to check environmentally friendly mining practices and sanctions imposed on defaulters. Reductions on taxes or compensations can be given to those with best practices. This will encourage many to follow suit.
3. Improve miners livelihoods by
  - teaching sustainable mining techniques to mitigate the negative environmental effects that mining generates;
  - giving them technical assistance by carrying out prospection and allocating zones for artisanal mining activities. This will reduce the anarchic destruction of the forest in search for productive deposits;
  - giving them opportunities to benefit from social insurance for a secure retirement;
  - creating forums where they are taught financial management and diversification of activities so they can change from mining to a different activity.



# 1. Introduction

Artisanal mining broadly refers to mining by individuals, groups, families or cooperatives with minimal mechanization, often in the informal sector of the market (Hentschel et al. 2002). Artisanal gold mining is carried out in developing countries of Africa, Oceania and Central and South America. According to Hentschel et al. (2002), globally the number of people estimated to be involved in this activity is 80–100 million people. Africa produces more than 60 metal and mineral products and is a major producer of several of the world's most important minerals and metals, including gold. Although underexplored, Africa hosts about 30% of the planet's mineral reserves, including 40% of gold, 60% of cobalt and 90% of the world's precious gems and mineral reserves (Tieguhong et al. 2009).

According to the World Bank Group (2001), "Small-scale mining is largely a poverty driven activity, typically practiced in the poorest and most remote rural areas of a country by a largely itinerant, poorly educated populace with few employment alternatives." Artisanal mining, despite being a livelihood sustaining activity is characterized by: a lack of or very reduced degree of mechanization; a low level of occupational safety; exploitation of marginal and very small deposits, which are not economically exploitable by mechanized mining; low productivity; low levels of income; lack of social security; insufficient consideration of environmental issues; and working illegally (Hentschel et al. 2002).

Mineral resources in Cameroon have not been exploited to date because of: a lack of information,

poor management, inadequate exploitation techniques and unfavorable conditions (MINEF 1996). This study aims to identify the problems and opportunities of this activity in the forest milieus in Cameroon and propose recommendations that can lead to more sustainable management of mineral resources and natural resources in general.

## 1.1 Objectives

The main objective of this study is to assess the impacts of artisanal gold mining on local livelihoods and the environment within the forested areas of Cameroon – in the Ngoyla-Mintom forest massif (NMFM).

### 1.1.1 Specific objectives:

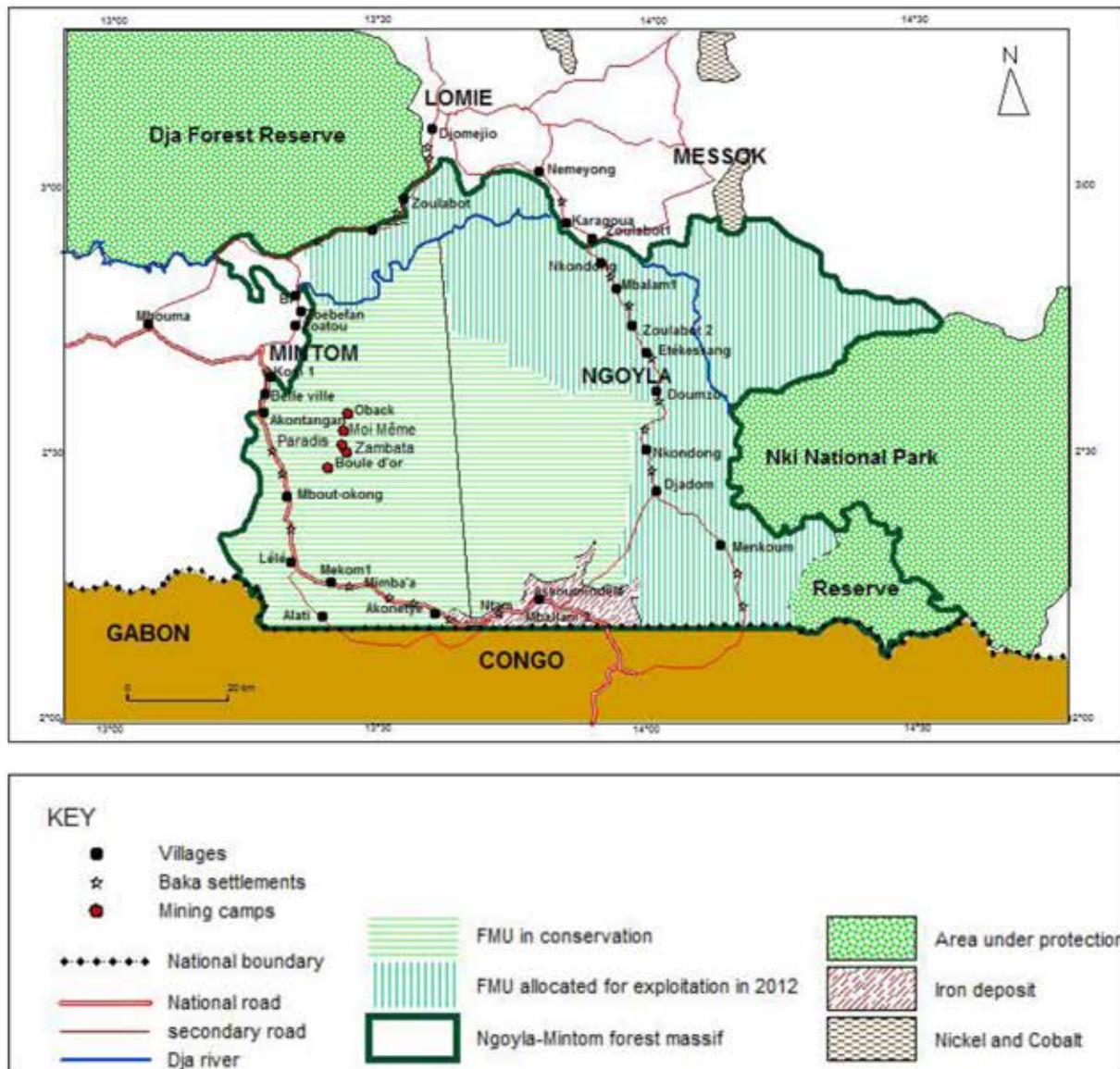
- Analyze the evolution of artisanal mining in the forested areas of Cameroon within the last 15 years.
- Study the genesis of a mining camp, social organization, working procedures, gold extraction, commercialization and the secondary activities which develop as a result of gold mining.
- Assess impacts of mining and of its associated activities on livelihoods.
- Assess the negative social effects of mining on the population.
- Assess the environmental impacts of mining on the forest.

## 2. Methodology

### 2.1 Presentation of the study site

This study was carried out in the Ngoyla-Mintom forest massif (NMF). The Ngoyla-Mintom forest massif is located in the south and east regions of Cameroon. The massif is made up of nine forest management units (FMUs). It gets its name from the two subdivisions it covers, which are the Mintom

subdivision in the south region and Ngoyla in the east region. The Ngoyla-Mintom forest massif is situated between latitudes 2°10' N and 3°00' N and longitudes 13°20' E and 14°35' E. The massif is limited to the north and the west by the Dja Biosphere Reserve, to the south by the Gabonese and Congolese borders, and to the east by Nki National Park. There is no agreement on the area of the



Map 1. Map of Ngoyla-Mintom forest massif and surveyed mining camps.

Source: MINFOF (2011)

Ngoyla-Mintom forest massif. Figures range between 932,142 ha (MINFOF 2006; WWF 2006) and 988,000 ha (World Bank 2010). The area is located between Dja Forest Reserve, Nki National Park (Cameroon) and Minkebe National Park (Gabon) and is part of the TRIDOM (made up of Dja, Odzala and Minkébé national parks in Cameroon, Congo, and Gabon, respectively) zone.

### 2.1.1 Administrative setup

The NMFM breakdown into administrative units is as follows: (i) the regions are headed by a governor; (ii) divisions are headed by a senior divisional officer; and (iii) the subdivision is headed by a divisional officer. Other forms of administrative divisions are the councils and the traditional chiefs (cant, groupings and villages). The councils are decentralized territorial authorities with legal authority and benefit from financial autonomy inside the division. The action of these communities aims to use local natural and human resources to ensure the economic, social and cultural development of its peoples. The NMFM is made up of two subdivisions: Ngoyla in the east and Mintom in the south region. Divisional officers are based in the headquarters of the divisions, in Ngoyla and Mintom towns. It is also made up of two decentralized council areas headed by elected mayors.

### 2.1.2 Physical characteristics

#### Geomorphology

The Ngoyla-Mintom forest massif is part of the southern Cameroon plate with an altitude of between 600–900 m and Precambrian formations showing vigorous creases. Extended erosion without a major tectonic shift has caused sub-horizontal topography in its general lines. The soils encountered in this massif developed from different parent rocks. These different substrata have given birth to different landforms. The mountainous terrains to the south of the Nyong, which extend from the region of Ngomedzap south of Ebolowa, is a zone of orthogenesis and granites of pyroxenes. The mineralogy of these soils includes quartz, kaolinite, goethite and gibbsite. The drainage network is dendritic and dense and the terrain is marked by the presence of hills with strong topographic elevations (MINFOF 2011).

#### Climate

The study zone is situated south of the fourth parallel where a hot humid equatorial climate dominates. This region has four seasons: two rainy seasons, from March to June and September to November, and two dry seasons from December to February and July to August. The mean annual temperature is 24°C and annual precipitation is between 1180 mm and 2350 mm. Annual thermo amplitude between the hottest and coldest month is 2°C. Relative humidity is always very high; the mean of the driest month is above 70% and that of the most humid month varies between 80% and 90%. Evapotranspiration rate ranges between 1150 and 1300 mm annually (Suchel 1988 in MINFOF 2011).

#### Hydrology

A dense network drains the Ngoyla-Mintom forest stand, which is part of the Congo River Basin. It is drained by a multitude of rivers, which feed the numerous swamps that cover this forested domain. It is greatly influenced by the Dja River, which drains the median part of the Cameroon Central Plateau, and other rivers such as: Ayina, Lélé, Myé, Karagoua, Nsogo, Lolobye, Boumba, Bek, Edjé, Lessogone, Kpasséle, Mindjebile, Ngoyla, Mwesse; and a multitude of minor tributaries (MINFOF 2011).

#### Plant and animal species

The Ngoyla-Mintom forest ecosystem is located in the Congolese 'Dja district' (Letouzey 1985). It is characterized by an absence of semi-deciduous forest species and Atlantic forest (including *Ceasalpiniaceae*, with the exception of the gregarious *Ceasalpiniaceae* such as *Gilbertiodendron dewevrei*), the presence of several species and some endemic genera known only in the Dja district, the swamp forests of Haut-Nyong, *Sterculia subviolacea* in the Congo Basin and important stands of *Uapacopaludosa*.

The vegetation consists of the following major groups: evergreen rain forests (82% of the total), complex of swamp forest (15%), a mosaic of secondary forests, plantations and agricultural areas inhabited (1%), and forest clearings (2%) (Letouzey 1985 in GEF 2012).

The plant and animal biodiversity associated with this variety of vegetation types is high. Indeed,

reconnaissance surveys carried out in the massif show the presence of more than 37 species of medium and large mammals (Nzoo 2003) and 228 species of fish (Ulrich 2007). In terms of other zoological groups (birds, reptiles, amphibians and Lepidoptera), evaluations conducted in adjacent protected areas (Boumba-Bek National Park, Nki National Park, Minkébé National Park and Dja Wildlife Reserve) show that they are equally represented (Dowsett-Lemaire and Dowsett 1998; Bobo 2002; MINFOF 2005).

Among the medium and large mammal species, are those internationally recognized as threatened, and highly sensitive to anthropogenic pressures or disturbance of their habitats such as the bongo (*Tragelaphus euryceros*), buffalo (*Syncerus caffer nanus*), the yellow-backed duiker (*Cephalophus sylvicultor*), the water chevrotain (*Hyemoschus aquaticus*), the forest elephant (*Loxodonta africana cyclotis*), which is smaller compared to its savannah counterpart, the lowland gorilla (*Gorilla gorilla*), chimpanzee (*Pan troglodytes*), mandrill (*Mandrillus sphinx*), leopard (*Panthera pardus*) and sitatunga (*Tragelaphus spekei*). According to the Indices of Kilometric Abundance (IKA) obtained during the reconnaissance survey conducted in 2003, the Ngoyla-Mintom is endowed with large populations of species of medium and large mammals (Nzoo 2003). These values, compared with those obtained in the adjacent protected areas (Ekobo 1988; Nzoo 1999, 2001; Wall and Nku 1999; Nzoo et al. 2006) in GEF (2012) suggest an estimated population of 3000 elephants, 4000 gorillas and 1500 chimpanzees. From the spatial distribution of the signs of activity of these species, it appears that high concentrations are in the central and southern areas of this forest, which is mainly dominated by swamp forests.

### 2.1.3 Socioeconomic background of NMFM

#### Population

The human environmental analysis of the area revealed about 13,000 inhabitants, including 3000 pygmies living in villages, street villages and camps located along roads and paths (Defo 2007a; WWF 2007). The population density of the Ngoyla-Mintom interzones (about 1 inhabitant/km<sup>2</sup> on average) is among the lowest in the southern Cameroon forest. The population of Cameroon was approximately 17 million in 2005, with a

population national density of 36.86 inhabitants/km<sup>2</sup>. This density varies from one region to another. The NMFM is one of the least populated areas of Cameroon. In 2001, the estimated densities of the population were 6.93 inhabitants/km<sup>2</sup> in the eastern region and 11.33 inhabitants/km<sup>2</sup> in the southern region, or 109,002 km<sup>2</sup> and 47,191 km<sup>2</sup>, respectively. The Ngoyla subdivision, which covers approximately 4382 km<sup>2</sup>, has a population density of approximately 1 inhabitant/km<sup>2</sup> and a total population of nearly 5000 people. The Mintom subdivision has approximately 7500 people. The population is young; 63% of the population in the study area is less than 25 years old (MINFOF 2011).

#### Socio-cultural setup

The population of the NMFM consists mainly of Baka, Djem, Fang, Nzimé and immigrants from other parts of the country, such as Bulu, Etôn, Bamoun, Bamiléké, Toupouri, Bassa, Maka, and Moudang. A majority of the Djem populate the study area, and are concentrated in the locality of Ngoyla. The Fang and Beti are more numerous in Mintom. In these two districts, about 30% of people are Baka. The other ethnic groups are mainly concentrated in the communities of Mintom, Mbalam II and Ntam. They are mostly composed of traders and seekers of employment. The official language most frequently spoken in the study area is French and the national languages most commonly used are Djem, Baka and Bulu (Defo 2007a; MINFOF 2011).

Healthcare, education and road infrastructure are social amenities that are still lacking in the NMFM. Healthcare infrastructure such as community and district health centers are found only at the district headquarters and remain inaccessible to a large majority of the population because of lack of roads linking villages to health clinics or lack of money.

#### Economic activity

The economic activities of the population of the NMFM area are diverse and consist of: agriculture, hunting, fishing, trade, collection of non-timber forest products (NTFPs) and small livestock rearing. Economic operators are present and community forestry is developing in certain areas (MINFOF 2011).



## 2.2 Importance of the Ngoyla-Mintom forest massif for conservation

The results of surveys conducted in the Dja Reserve and in this forest, as well as wildlife inventories conducted in Minkebe National Park (MIKE 2005) and Nki National Park have confirmed the existence of elephant migration corridors between the Ngoyla-Mintom massif, Dja Reserve (southeast), Nki National Park (southwest) and the forest of Souanké-Sembé (Congo). The distribution of elephant populations suggests the existence of another migration corridor between the Ngoyla-Mintom massif and forest management units 09-005a and 09-003 (between the villages of Lele and Mintom), but which is now broken because of the settling of the population along the highway Mintom–Lele. The existence of these connections demonstrates the importance of the forests of Ngoyla-Mintom in the genetic flow between animal populations in the protected areas of Dja, Boumba-Bek, Nki and Minkébé (Gabon).

Cameroon has 22.5 million ha of forest and the Ngoyla-Mintom forest massif occupies a strategic position as it covers a total surface area of 988,000 ha and lies between the eastern and southern regions, which are the two regions that carry the largest surface area of forest in the country. Located within the TRIDOM landscape, it is a conservation zone of world importance, and the object of a concerted accord signed in 2005 in Brazzaville between Cameroon, Congo and Gabon. This area has been kept aside for conservation and sustainable management of natural resources since the colonial period; the forest is made up of nine forest management units (FMUs). The Ngoyla-Mintom forest is at the center of a number of developmental projects in the country today, notably mining projects of cobalt, nickel and manganese in Nkamou, the construction of a dam over the Mekin River and several other projects (Nzoo 1999).

The Government of Cameroon, through the Ministry of Forestry and Wildlife (MINFOF), has engaged with the assistance of the World Bank, the preparatory phase of the Conservation and Sustainable Management of the Ngoyla-Mintom Forest Project. This project's budget is estimated at US\$ 6.7 million, with US\$ 3.5 million provided by Global Environment Facility (GEF) and US\$ 3.2 million provided by the Government of Cameroon (MINFOF 2011). The World Bank under project

number P118018 approved the project in April 2012 (World Bank 2013).

## 2.3 Data collection

Methods used for the collection of data for this study were as follows:

- A thorough review of documentation from existing reports from MINMIDT, CAPAM, MINFOF, MINEF and other concerned bodies, institutions and websites was carried out as part of the rationale for this project. A literature review of books, articles, and laws relating to mining operations and related activities was also done.
- A visit to eight mining sites on the field was conducted between October and November 2013. Miners were interviewed using a guided questionnaire to collect data on their income, evaluate the difficulties they faced, and other livelihood strategies they used. Their perceptions and views on possible environmental impacts of mining on the forest were also sought. A total of 95 miners were interviewed using questionnaires in the eight mining camps that were surveyed.
- A number of focus-group discussions were organized with field actors associated with livelihood sustaining activities linked to mining. Stakeholder consultations were also done.
- A GPS tool was used to map the distribution of artisanal mining camps in the field and photographic documentation was conducted.

## 2.4 Data analysis

Data analysis was done in three phases: data entry, analysis and correction.

Data collected from the field was entered into Excel and then transferred into SPSS Program Version 16.0 for descriptive analysis. Maps were prepared using MapInfo 8.0 software. Graphs, maps, tables and other statistical tools were used for data analysis and interpretation.

### 2.4.1 Limitations to the study

This study was carried out during the rainy season when access to mining camps is very difficult due to the high water level in the rivers and forest swamps that lead to these camps. It was difficult to

obtain miners' monthly production because many miners could not recall with precision their monthly production. This made it difficult to calculate miners' income.

Since mining is being practiced illegally, and miners are being constantly harassed by unscrupulous uniformed men, many refused to answer our questions as they thought members of the survey team were spies.

# 3. Background

## 3.1 Cameroon's mining sector overview

Mining has been practiced in Cameroon since before independence. Gold, rutile and tin have been mined here since the early 1900s. Artisanal gold mining started in 1933 with the production of about 20 metric ton or tonne (t) between 1934 and 1984, or an average annual production of 1500 kg (Mbendi 2009). According to Laplaine (1969), investors ran an unsuccessful mechanized production of gold operation in Cameroon between 1948 and 1955. Tin was mined from 1933 to 1968 in the Adamawa region at Mayo Darlé, with a total production of 6500 t. Rutile was mined between 1935 and 1955 in the central region at Otélé, Elog Batindi with a total production of 16,500 t. All of these resources were exploited by artisanal mining and any attempt to introduce mechanization was unsuccessful (Penaye et al. 2013).

The artisanal mining sector before independence contributed to over 20% of the economy, 11.7% by 1939, increased to 20% during World War II, fell to 5.5% in 1945 and 0.6% in 1959 (CAPAM 2013).

## 3.2 Cameroon's mining potential

Cameroon has one of the richest subsoils in sub-Saharan Africa. This rich potential is not yet fully developed but there are huge mining projects underway. Cameroon has extensive bauxite reserves in Mini-Martap and Ngaoundal (1100 t of bauxite reserves) in the Adamawa region of northern Cameroon. The country is destined to be a major iron producer and the hub of the Central African iron supply chain – the Mbalam Iron Ore Project will produce 35 million t of iron ore per annum. The Mbalam iron ore deposit is estimated at 2.5 billion t at 40% and in Kribi it is estimated at 350 million t at 35%. Akonolinga has rutile deposits with geological reserves of about 300 million t at 0.9%; Mobilong diamond deposits with reserves estimated at 700 million carats were discovered in 2008. Cameroon

joined the Kimberly process in 2012 for the certification of the Mobilong diamond, paving the way for its output. Limestone and marble are found mainly in the northern part of the country with reserves of limestone deposits in Figuil (600,000 t) and marble in Bidzar (2,500,000 t). Other limestone deposits were found in the southwest (Moko, Mbalangi and Bogongo), the south (Mintom) and the Littoral region (GESP 2010; Mbendi 2010; CAPAM 2013; CIMEC 2013).

This makes Cameroon one of Africa's most exciting mining destinations, with over 600 research and mining permits already granted to companies within the last three years, as of March 2013 (CIMEC 2013).

Previously, exploration for gold in Cameroon was carried out by the artisanal sector, but now major mining exploration companies are conducting gold exploration. Positive results have been achieved in Betare Oya, Bindiba, Colomine and Ngoura in the eastern region where exploration and mining permits have been granted, with a total declared production of 447 kg in 2013 (CAPAM 2013).

## 3.3 Legislation and mining policy

Cameroon's geological and mining sector has two main areas of focus: scientific and industrial. The Ministry of Scientific and Technical Research, oversees a variety of research institutes in the areas of: geology and geophysics, hydrology, and energy. The Ministry of Industries, Mines and Technological Development (MINMIDT) is responsible for industrial development and for the national geological survey through the Directorates of Mines and Geology.

Several laws under different ministerial departments each regulate mining in Cameroon, with each playing a specific role: notably the mining code, tax code and other laws governing the fiscal regime, and laws governing the environment.

### 3.3.1 The Mining Code

The Mining Code of 2001 adopted and promulgated Law No. 001 of 16 April 2001, and its Application Decree No. 2002/046PM of 26 March 2002 regulate the mining sector in Cameroon. The mining code was voted by the national assembly and promulgated by the head of State under Law No. 001 of 16 April 2001 (Republic of Cameroon, 2001) and Application Decree No. 2002/046PM 26 March 2002 (Republic of Cameroon, 2002) signed by the prime minister. This law revoked any other existing law that regulated the mining sector before then, notably Law No. 64/LF/3 of April 1964 governing mineral substances and Law No. 78/24 of December 1978 fixing the fiscal regime for collecting mining revenue. The new law is more detailed than the old one. Made up of 116 articles, we notice significant advancement in several domains, such as protection of the environment, the recognition of the status of artisanal miners and the encouragement of foreign investment (CAPAM 2012).

The tax code is the responsibility of the Ministry of Finance (MINFI). This ministry collects government revenue (customs and taxes) from different activities in the country under different directorates.

## 3.4 Forest policy and legislation in Cameroon

Cameroonian forests have a long history of regulatory and institutional settings. During the colonial period, Germany, the UK and France had administrative units in place to regulate the forestry sector, and after independence, new forest laws were adopted by the Republic of Cameroon in 1974 and 1981 (Cerutti et al. 2008). In 1994, Forest Law No. 94-01 of 20 January 1994 regulating forests, wildlife and fisheries (Republic of Cameroon 1994) was voted and then implemented through Decree No. 95-53-PM of 23 August 1995 (Republic of Cameroon 1995). With the adoption of a new forest law, a comprehensive national forest policy framework was laid down, directly linking the concepts of sustainable forest management with the preparation of FMPs for all productive forests. The 1994 law had four main objectives, notably:

- better protection of the national forest patrimony;
- protection of the environment and biodiversity;
- amelioration of the living conditions of the people through the integration of forestry in rural development;

- increasing the contribution of the forestry sector to the country's GDP.

One of the most important aspects of Cameroon's 1994 law on the forest regime is the division of its forestlands into two domains: the permanent forest estate (PFE) and the non-permanent forest estate (NPFE) (Articles 20–39). The law stipulates that PFE lands should occupy at least 30% of the national territory, be representative of the national biodiversity, permanently serve as forest and/or habitat for wildlife and be sustainably managed according to approved management plans. The NPFE comprises lands that can be used for purposes other than forestry. The overarching principle is that all forestlands in Cameroon are under some form of State control. The PFE includes production and protection forests, which can be in the public or private domain, as well as council forests, which may also be designated for production or protection and which are in the private domain of a council. Forests in the NPFE are in the national domain; they are recognized as part of a collective patrimony managed by the State, but they may be privately owned under certain circumstances. This category is zoned as agroforestry and includes community crops, community forests and in some cases, private forests.

## 3.5 Link between mining and the forest

Mining activities carried out within forest milieus are governed by two different legal frameworks, notably Law No. 001 of 16 April 2001 governing the mining sector as the mining code and Law No. 94-01 of 20 January 1994 regulating forests, wildlife and fisheries.

No in-depth study has been conducted on the agreement between forestry laws and laws on sectors such as land tenure, mining, water resources and energy, agriculture and infrastructure. There are conflicts of interest and overlapping rights and obligations, which reflect the urgent need for such research and appropriate decision-making. An example of the lack of compatibility between the forestry and mining laws is that mining permits have been issued for sections of national protected areas (Lobéké and Boumba Bek National Parks, part of the Sangha Tri-National Park, which is soon to be designated a world heritage site, and the Douala Edea Wildlife Reserve) and for forest concessions such as



the registered concession in the east (Nguiffo and Ngujepjouw 2009).

### 3.5.1 Socioeconomic impacts of artisanal mining

Artisanal mining is an attractive employment option for many in rural areas; the barriers to entry are minimal – low technology and little capital is needed. Activity levels are dynamic as precious minerals are often inversely correlated with economic opportunity and periods of economic crisis. Artisanal and small-scale mining generates income; minerals provide higher income than other traditional activities within rural mining communities in the Sangha Tri National landscape in central Africa (Ingram et al. 2011). Kitula (2006) states that the presence of mining activities in Geita district in Tanzania has created market opportunities for local farmers and small traders, and employment opportunities for others.

Artisanal gold mining is associated with many social problems. Kitula (2006) indicates that local populations are marginalized and oppressed, especially those from lower economic classes, by miners in the Geita district in Tanzania. Communities are exposed to chemical contaminants, heat stress, unsanitary conditions, malaria, prostitution, poor diets, drug-taking and alcoholism (Walle and Jennings 2001). Women and children are most affected. The participation of women in artisanal gold mining varies depending on local beliefs from different countries and communities. Their role is not limited to mining activities and includes the supply of food, tools and equipment and sex services that exposes them to sexually transmitted diseases and HIV/AIDS (Hentschel et al. 2002). Children start washing gold as young as 3; from 6 they begin breaking hard rocks with hammers and from the ages of 9 to 12 they go underground

and do the same work as the older men (Hentschel et al. 2002).

The environmental impacts of small-scale mining have been studied worldwide. The main impacts are deforestation and land degradation; open pits which are animal traps and health hazards; stagnant water in excavated holes that are abandoned by the miners, providing breeding ground for mosquitoes; mercury use for gold amalgamation, inefficient extraction, dust and noise; underground and long-term hazards (Labonne and Gilman 1999; Hentschel 2000, 2002; UNESCO 2003 in Tieguhong et al. (2009); USAID 2000).

One of the most significant environmental impacts is derived from the use of mercury (Hg). It is a pollutant causing growing concern because of its long-term impacts on ecosystems and human health. Artisanal and small-scale mining, in contrast to other sectors where mercury utilization is decreasing, remains a dangerous source of mercury pollution (UNIDO 2009).

Article 16 of the 1994 Law on Forestry states that an environmental impact assessment study must be conducted before any project is carried out within any forest domain on national territory. Local populations report that they are unaware of this law and there is little done in terms of its implementation by the concerned authorities (Tieguhong et al. 2009).

However, small-scale mines are testimonies for the existence of mineral resources, with alluvial production often close to primary sources, for industrial discoveries are a way of discovering industrial mining deposits. Small-scale mining operations are often appropriate activities for marginal deposits, in places where industrial exploitation might not be economically feasible (Gweth 2003).



## 4. Results

The mining population in NMFM has increased tremendously within the last four years to an estimated 1000 people. In 2011, the Gabonese Government evicted all miners who were operating illegally in the Minkebe forest area. A large number of Cameroonians were working there, as well as people from different African countries. Most of these people took refuge in the Ngoyla-Mintom forest massif and other localities in the eastern region of the country where artisanal mining is being practiced, thereby increasing the population of miners here.

The study was carried out during the rainy season, which is a period less favorable for mining activities in Ngoyla-Mintom as 98% of mining is alluvial. During this time of the year, the rivers, streams and swamps where mining is being practiced are flooded. However, miners do not have fixed working calendars and many were present when we visited the mining camps.

Eight mining camps were surveyed at the periphery of Mintom. Artisanal gold mining in the NMFM is concentrated in Mintom and its surrounding area. A total of 95 miners were interviewed in the eight mining camps. These mining camps had a total population estimated at 497 people at the time the survey was carried out, made up of both miners and people practicing other subsidiary activities such as catering and portering etc. From this population

an estimated 300 were miners. The oldest of these mining camps was 20 years old and the most recent camp was 1 year old (Table 1).

### 4.1 Bio data of respondents

#### 4.1.1 Age of miners

From results obtained in the field, the majority (80%) of miners were less than 35 years of age. The ages of miners ranged from 15 to 65 years. Mining is a labor intensive activity and is only suitable for the young and strong. Only two miners were found to be above 50 years of age (Figure 1). The study was carried out during school periods so many children were not found in the camps, except those who had dropped out of school. Many miners reported that

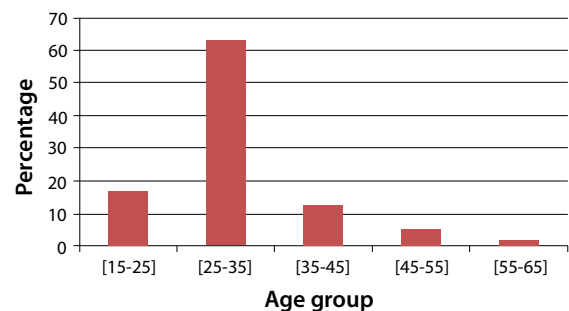


Figure 1. Age group of miners.

Table 1. Mining camps in the NMFM.

Mining camp	Frequency	Percentage	Estimated population	Age of camp
Boule d'or	20	21.1	120	3
Cool	7	7.4	80	2
Moi meme	5	5.3	12	1
Mvan	8	8.4	30	7
Nzom	11	11.6	50	20
Obac	18	18.9	130	8
Paradis terrestre	12	12.6	25	6
Zambata	14	14.7	50	15
<b>Total</b>	<b>95</b>	<b>100.0</b>	<b>497</b>	

during the school holidays, their children came and worked at the mine.

#### 4.1.2 Gender of miners

Out of the 95 miners interviewed, only 3 were women or 3.2% of the sample size. Women are not involved directly in mining activities in Ngoyla-Mintom as mining requires much physical strength, and because of local beliefs. According to local beliefs, the gods get angry and take away gold from the mine when women carry out mining, especially during their periods or when they are pregnant. Women are allowed to own holes but they pay men to do the digging and participate in the washing. However, some women did not abide by local beliefs and dug holes themselves in Obac and Zambata mining settlements. They were generally women from other parts of the country who did not heed the local beliefs in the NMFm.

#### 4.1.3 Nationality of miners

Over 84% of miners were of Cameroonian nationality. People from six other African countries were interviewed in the field; they were from Burkina Faso (4.2%), Central African Republic (2.1%), Chad (1.1%), Gabon (2.1%), Mali (4.2%), and Niger (2.1%) (Table 2). People from other countries such as Cote d'Ivoire and Benin also worked in the mining settlements that were visited but were afraid to answer questions because most of them had entered the country clandestinely and were illegal workers.

#### 4.1.4 Ethnic origin of miners

Cameroonian miners came from 13 different ethnic groups in the eight mining camps surveyed. People came from all over the country to work in the mines. The most representative of all the ethnic groups were Bulu (22.1%) who make up the majority in the southern region, followed by Ewondo (16.8%), Bamileke (9.5%) and Fang (8.4%). These different ethnic groups showed the diversity of Cameroon, which has over 250 different ethnic groups. Non-nationals represented 14.7% of the total population of miners (Table 3).

The indigenous Baka people were not involved in mining activities, in contrast to the Fang who constituted 8.4% of ethnic groups. They were found in some of the mining settlements, but they provided

**Table 2. Nationality of miners in NMFm.**

Country	Frequency	Percentage
Burkina Faso	3	3.2
Cameroon	81	85.3
Central African Republic	2	2.1
Chad	1	1.1
Gabon	2	2.1
Mali	4	4.2
Niger	2	2.1
<b>Total</b>	<b>95</b>	<b>100</b>

**Table 3. Miners in NMFm by ethnic group.**

Ethnic group	Frequency	Percentage
Bakweri	1	1.1
Bassa	4	4.2
Bamileke	9	9.5
Bulu	21	22.1
Eton	6	6.3
Ewondo	16	16.8
Fang	8	8.4
Foulbe	4	4.2
Maka'a	2	2.1
Menchum	1	1.1
Ngemba	5	5.3
Nkonda	1	1.1
Non nationals	14	14.7
Toupouri	3	3.2
<b>Total</b>	<b>95</b>	<b>100.0</b>

different services such as portering and selling their farm and forest produce.

#### 4.1.5 Education

To report miners' level of education, the highest class attended was taken into consideration rather than certificate obtained. It was found that those who attend secondary education without obtaining the final certificate were more educated than those who did not go at all. This helped to obtain the percentage of school dropouts among miners. Among the 95 miners surveyed, 10% of them had not received any formal education. Almost a third of miners (29%) had the First School Leaving



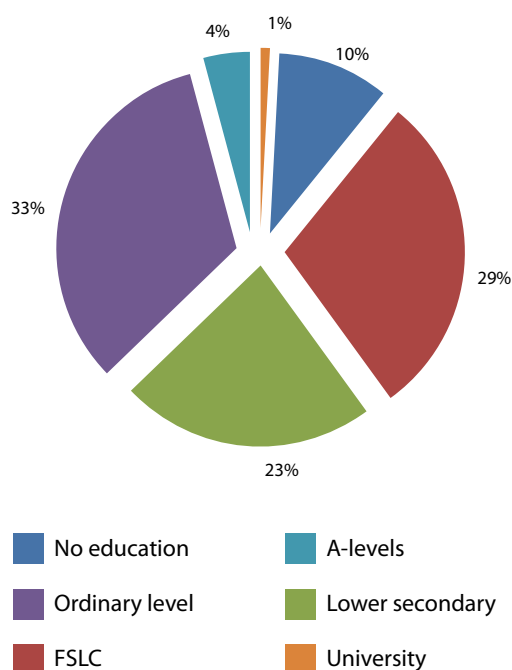


Figure 2. Level of education among miners in NMFM.

Certificate (FSLC) (equivalent to the *certificat d'étude primaires* in the francophone subsystem of education in Cameroon CEP). A total of 23% of miners surveyed were secondary school dropouts – 33% of miners had the ordinary level certificate, 4% had the advanced level certificate and only 1 miner had a university education.

#### 4.1.6 Marital status

Marriage is an important social function among the people of the southern region of Cameroon. Young boys get married at a young age (19 as was observed in the field during this study). A total of 51 marriages were recorded in 54% of total miners surveyed, with 2 divorces and 1 widowed from a total of 57% compared to 43% who were single. Only two cases of polygamy were reported. Those generally not married were either non-nationals or youths who just came temporarily to make money from mining and then leave.

#### 4.1.7 Miners' first profession before joining mining

Miners came from diverse fields of work to make their fortune in the mining sector. Only 48.4% of miners surveyed had no fixed profession before joining the mining sector and so listed

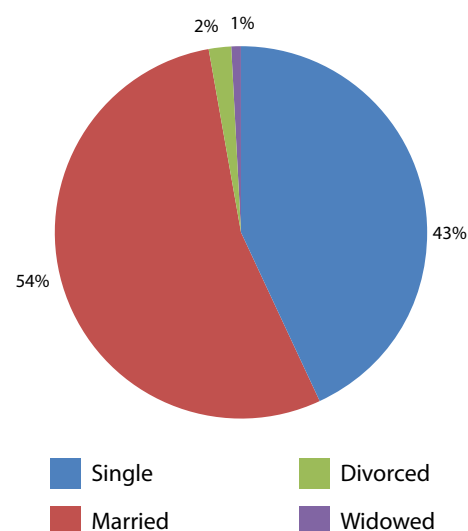


Figure 3. Marital status of miners in NMFM.

Table 4. Miners first profession

Profession	Frequency	Percentage
Builder	2	2.1
Business person	11	11.6
Electrician	6	6.3
Farmer	13	13.7
Mechanic	8	8.4
Miner	46	48.4
Teacher	1	1.1
Woodworker	8	8.4
<b>Total</b>	<b>95</b>	<b>100</b>

mining as their main profession. Mining is an activity that does not require any particular training. Mining experience is an additional skill for better prospection and efficiency at work. Miner's professions ranged from motor mechanics to carpenters, drivers, electricians, farmers, business people and teachers (Table 4).

#### 4.1.8 Number of children and dependents per miner

A total of 496 dependents, including 167 children were counted for the 95 miners interviewed. The average number of children and dependents per interviewee was 1.8 and 5.2, respectively. Extrapolating on the estimated 497 total population in the mining camps gave 894 children and 2584

dependents. The dependency ratio of Cameroon stands at an estimated 86.2% in 2013 (World Bank 2012). African culture places a higher value on the size of a family than on the riches the family possesses. It was common to see brother in-laws, cousins, nephews, uncles and aunts together with husbands or wives and parents living in the same hut. Miners need very high incomes to meet the needs of their huge dependent families. These figures revealed miners' dependency on mining income. This revealed that higher incomes attract more family dependents. Those with higher incomes had more dependents than those with lower incomes.

## 4.2 Social structure of mining communities in NMFM

Like every human society, artisanal mining camps in the forested areas in Cameroon are organized in a hierarchical manner. The head of the camp is generally the person who started the camp. As explained by the miners, a camp starts by prospection, which can be done by anybody. Many minor camps exist at the periphery of bigger ones, as is the case with Boule d'or, which is the center and supply point to other minor camps such as Zambata, Cool and Paradis terrestre.

### 4.2.1 Leadership

The leader of a camp is generally the person who discovered the deposit (*chef de chantier* in French). Discovery is through prospection. Usually discovery is done by hunters who already work in an existing mine. People move from either a forest farm settlement or an existing camp to the areas around the river courses and swamps and bore shallow prospection holes at the periphery of the settlements. The gravel is washed and production reveals a promising deposit or not. If the results are promising, a deeper hole is dug to confirm the previous results obtained. Once affirmed as being a good deposit, a camp is set up a few meters from the mine, generally on a slope. Trees are cleared and felled around the settlement to allow for better sunlight. The discoverer of a deposit is the natural head of the camp and he outlines his working and settlement principles. He designates an assistant who is either a close family member or a trusted friend.

The first inhabitants of a camp are the *chef de chantier* and his immediate family; other relatives and friends

then follow. The growth in the population of a camp depends on gold production. If production is good, many more people, both miners and businessmen, will rush in to get a share in a short period of time. Information will spread about the mine locally as miners work there and go back to the village for supplies.

### 4.2.2 Settlement pattern in mining camps

The settlement pattern in most mining camps is self-organized into ethnic affiliation. Miners group themselves according to their ethnic origins. Foreigners generally settle at the extreme end of the camp, far away from the entrance so they will have enough time to escape into the forest if there are visits by security forces or administrative authorities. This is because their resident status is not always regularized. The market and any other businesses are usually situated in the center of the camp. The *chef de chantier* and his entourage always have the best portions of land since they are the first inhabitants of the camp. Mining camps look more like small towns than the impermanent settlements, which they are. Some people take permanent settlement in these camps and only leave them to go to the villages to purchase basic necessities.

### 4.2.3 Organization of labor

The head of a mine organizes the work in his mine. When a newcomer arrives, he first works for the chief. The chief shows him a portion of land where he must dig for him. The duration of the job depends on the newcomer's abilities and his rate of work. The entirety of the gravel removed from the hole dug and all the gold that is produced from it belongs to the *chef*. This is called the "chef's right" or "new man's tax". After this is completed, the new man is shown his own portion of land where he can dig. Whatever he produces from that belongs to him. Tetsopgang et al. (2007) state that in the eastern part of the country in Betare-Oya and many other localities, the owner of a mine gets a percentage of all produce from his mine. The situation is different here: artisans affirmed that once the new man's tax is paid, nothing more is owed to the *chef du chantier*, except as a gift from an individual who may give him something after a fruitful wash. However, the *chef du chantier* can ask for the contribution of each miner when there is a pressing matter to solve which concerns all.

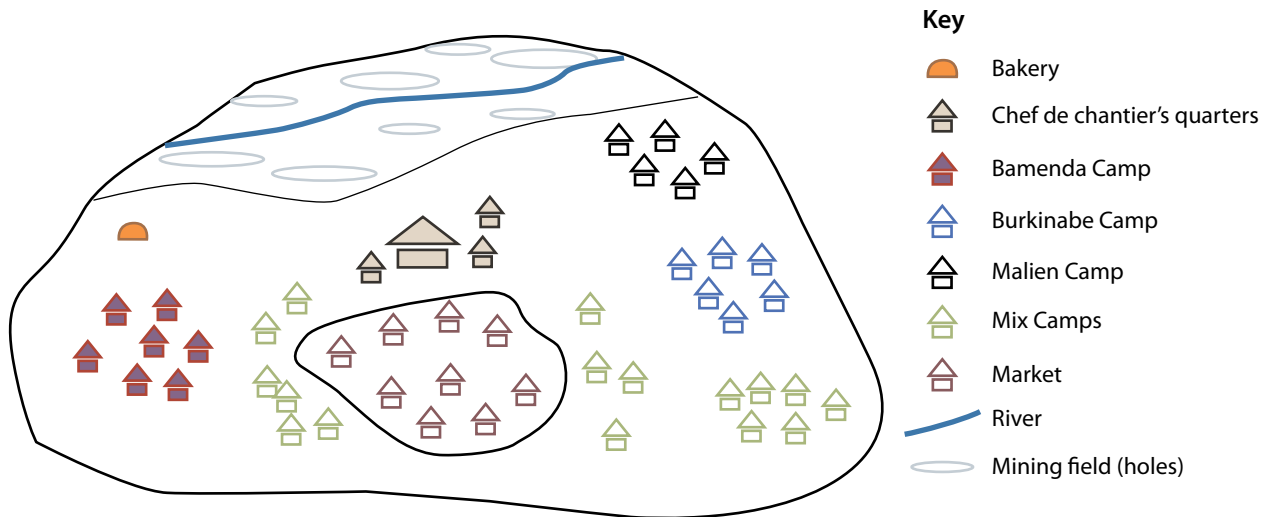


Figure 4. Settlement pattern in mining camps in NMFM: Case of Boule d'or camp.

Here a fixed rate in cash is attributed to each miner depending on whether he owns a hole or not.

About 70% of the miners affirmed that mining was their principal activity. The other 30% carried out mining alongside other activities. The majority (75.8%) of miners interviewed had spent less than five years in mining (Figure 5). This is because mining is a recent activity in the region and many of the artisans do not yet have many years of experience. Those found with 10 years of experience and above are people who started practicing mining elsewhere first.

Miners were asked to explain how they joined mining activities. A third of them (30.5%) said

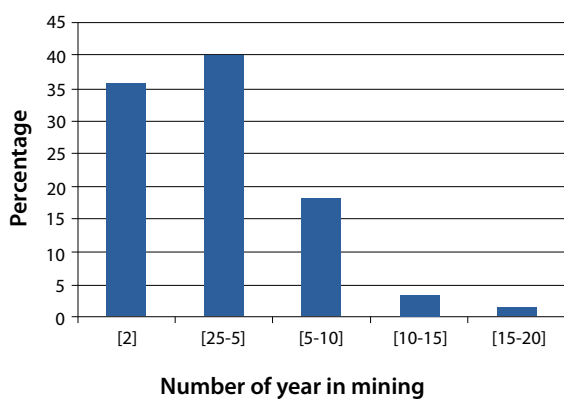


Figure 5. Miners longevity in mining.

their family members (brothers, sisters, parents and in-laws) initiated them. A total of 36.8% of miners joined mining through friends, who came, joined the activity and later on sent news for them to come. The remaining 32% of miners reported that they joined the activity by accident and in search of fortune. Some came for business and then found themselves in mining; others just left their homes for adventure and ended up in mining camps. In Boule d'Or the *chef de chantier* told us that mining camps are hideouts for criminals, as these places are almost cut-off from civilization, fugitives hide out there. Sometimes law enforcement agents come for controls.

Mining camps can last for up to 15 years. A camp's life-span depends on its production and the discovery of new productive ones at its periphery. Even when exhausted, camps are not completely abandoned. The population can be reduced to a few individuals, generally the *chef du chantier* and his family. They may live there and go to work in different mines nearby.

#### 4.2.4 Typology of miners in NMFM

Four types of miners were identified: individual miners, grouped workers, laborers and entrepreneurs.

**Individual miners** generally own their holes. They work for their personal accounts. These set of miners

either work with family members such as their wives, children, siblings or hired labor. Independent miners hire out their services in times of financial difficulties.

**Laborers** are generally people who do not own holes and work for individual miners for a daily, weekly or monthly payment, or they are hired on a contract basis (to dig a hole and extract the gravel). Laborers are sometimes paid a percentage of their production through a verbal contract between the laborer and the employer before he commences the work. The duration of the job depends on the laborer's work rate. The terms of a contract can be changed in the course of time as deemed necessary and accepted by the two parties concerned.

**Grouped workers** are those who work collectively. A group is made up of two or more people. Two types of groups were identified: a group made up of independent workers who form a *njangui* where all members of the group help themselves especially during digging; the second type of group is made up of individuals who pool their resources together and work collectively. When washing has been done and the product is sold, the money is shared according to each person's contribution. Labor is shared accordingly to avoid quarrels during sharing. Those who invest more, receive more.

The last type of miners is the **entrepreneur**. Entrepreneurs do not work in the holes. They are generally businesspersons, collectors, individuals (settled in the mines or not) who provide the materials and finances needed. They hire laborers who do the digging and washing for them. The laborers are then paid as agreed from the work contract. The contract is usually a verbal contract and miners respect it.

The majority (82.1%) of miners confirmed that they owned their own holes; 17.9% were laborers; 12% were grouped workers and 5% were entrepreneurs. The total gives 117% because individual miners sometimes hired out their services as laborers or worked in groups, and vice versa. Entrepreneurs (rich miners) did not hire out their labor.

#### 4.2.5 Labor and remuneration

Almost half (49.5%) of miners worked alone and did not use hired, group or any form of labor. Miners were assisted by family members or by hired labor.

**Table 5. Total work force per miner.**

Number of workers	Frequency	Percentage
No worker	47	49.5
2	18	18.9
3	11	11.6
4	11	11.6
5	6	6.3
6	2	2.1
<b>Total</b>	<b>95</b>	<b>100</b>

**Table 6. Mode of remuneration of labor by miners in NMFM.**

Mode of remuneration	Frequency	Percentage
No worker	47	49.5
Percentage of profit	13	13.7
Daily	24	25.3
Weekly	5	5.1
Monthly	6	6.3
<b>Total</b>	<b>95</b>	<b>100</b>

The total work force of each miner ranged from 2 to 6 workers (Table 5). Miners did not usually keep permanent workers, except for those who worked with family members or hired workers on a monthly basis. Miners hired labor for specific tasks – digging or washing. Miners hired labor for the tasks they find difficult carrying out.

Labor was paid on a daily, weekly, monthly basis or a percentage of what was produced (Table 6). It was between XAF 3000 (US\$ 6) and XAF 5000 XAF (US\$ 10) per day. In very rare cases, miners receive up to XAF 7000 as a daily payment. Some miners who were paid XAF 3000 were provided a daily ration of food. For weekly payments, the number of days worked in the week was multiplied by the daily payment. Miners received between XAF 140,000 (US\$ 280) and XAF 200,000 (US\$ 400) as a monthly salary, depending on their daily payment.

#### 4.3 Mining techniques and procedures

The techniques used for mining around the world are almost identical. Each community of miners adapt the existing techniques to suit their context



Photo 1. A wooden sluice box and gold washing process in NMFM.

and environment. The techniques of mining consist of digging a hole at a pre-prospected site. The depth of the hole depends on the depth of the gold bearing gravel. The average depth of holes in the NMFM is 2 m deep.

Since mining is practiced in swamps and lowland areas, holes are constantly being filled by water as miners dig. Motorized pumps are used to bail out this water. During the rainy season water is always a major problem for miners. In certain places motorized pumps are left to run all night and day, even when miners are not working to avoid flooding of the holes. Once the gravel is reached, a portion of land is cleared and the gravel removed is deposited in heaps. The washing process starts immediately. A wooden sluice box of about 1.5 m in diameter mounted on another of about 1.5 m in diameter and 3 m in length is used for washing the gravel. The latter box is built in the form of a rectangular canoe and a wool carpet is put inside to trap gold particles. A solid wire mesh is placed inside the box to retain large stones and pieces of wood (photo 1).

The gravel is put inside the small box and with a motorized pump, and water is pumped into the sand. As water carry the sand down the steps of wooden riffles that had been earlier placed on its route, the carpet and the riffles trap the gold particles. The carpet's content is then washed in a *bate*. At this stage there are still pebbles and sand that stick to the gold. The last stage of extraction is panning using a *bate*. The final content is heated with fire in a *bate* to dry up water left. The gold is then placed on a small piece of paper (white preferably) and any remaining sand particles are blown out delicately with the mouth.

#### 4.3.1 Evolution and change in mining techniques in NMFM

The techniques used in mining in NMFM have not always been the same. A total of 58% of miners confirmed a change in the techniques that they have been using to mine. The other 42% was made up of young miners who have not been mining long enough to witness changes. Changes have occurred in the materials used and in the techniques of washing. In the past miners did not use motorized pumps to bail water from holes. Washing and bailing of holes was done by hand. The size and type of washing tables has also changed. Miners say their production has increased since the introduction of wool carpets because more gold particles are trapped. Some miners attributed these innovations to government support through CAPAM, which gave them working tools (motorized pumps and spades) in 2009. Other miners reported that innovations were introduced by miners from the Minkebe massif in Gabon where artisanal mining has been practiced for a long time.

When asked if they had a specific working calendar, 82% of miners said they work all year round. Many said they usually take short breaks to visit their families. The other 18% was made up of miners who carried out other seasonal activities such as farming.

Artisanal mining in NMFM has improved with the introduction of small-scale mechanized mining. In Obac, a mining entrepreneur carried out small-scale mechanized mining. He owned a small caterpillar machine for digging and washing. The road to the mine, which is about 17 km from the road, was dug by the entrepreneur using his caterpillar machine.

### 4.3.2 Cost of working materials and production

#### Working material

The cost of working materials varied from one mining camp to the other and is determined by the distance from the road to the mine. Miners calculate this distance as the time needed to cover this distance on foot, not in km. The minimum cost of working materials is their cost in the nearest town market and their maximum cost is the price at which they are purchased in the furthest mine sampled. The minimum amount needed by miners to purchase the basic necessary materials was XAF 218,000. Not all miners owned these materials, but they had the indispensable tools such as the spade, machete and diggers and/or mining bar. The other materials such as the washing table and motorized pump is either borrowed or rented when the need arises (Table 7).

All gold mined in the NMFM is sold unprocessed. The quantity produced is too small to be processed and there are no gold smelting smiths in the region.

Because miners mine through trial and error, production is not always certain. It was difficult to determine miners' monthly production because many miners could not recall with precision their monthly production. This made it difficult to calculate their income. Data on production was obtained by asking miners to state their daily or weekly production. The length of time taken for each trip was taken into consideration as some miners can take up to a month for one trip. All data collected on miners production was converted into monthly production. Over 17% of miners produced between 5 and 10 grams of gold per month (Figure 6).

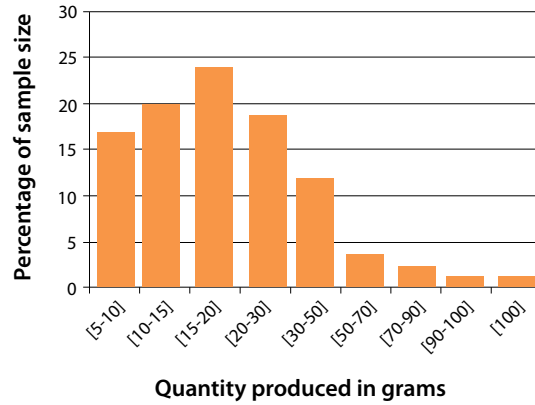


Figure 6. Monthly gold production in NMFM.

Gold was the only mineral exploited by artisanal miners in NMFM. All miners interviewed confirmed that they did not use chemicals in the process of mining or treatment of gold. We did not observe any use of chemicals.

The divisional officer for Mintom reported that five artisanal mining permits were delivered for the Mintom subdivision. The regional delegate in charge of mines for the region concerned awards the artisanal mining permit in Cameroon. Only one of the owners of the permits was operational and accepted to be interviewed. He reported that he had spent over XAF 1,800,000 to obtain the permit. Due to administrative bottlenecks and corruption, obtaining a permit entails much money and time, which artisanal miners do not possess. The majority (92%) of miners said they were aware that there are laws governing the mining sector, but acknowledged that they do not respect these laws. Many told us that

Table 7. Materials and costs in NMFM.

Material	Minimum cost (XAF)	Maximum cost (XAF)
Spade ( <i>pelle</i> )	10,000	10,000
Crowbar ( <i>barre à mine</i> )	15,000	25,000
Wooden sluice box ( <i>table de lavage</i> )	25,000	35,000
Bate	3,000	5,000
Pickaxe	5,000	5,000
Machete	5,000	5,000
Boots	5,000	7,000
Motorized pump (with all accessories)	130,000	150,000
<b>Total</b>	<b>218,000</b>	<b>242,000</b>



**Table 8. Miners perception on owning a mining permit.**

Miners responses	Frequency	Percentage
No difference	39	41
Free marketing	19	20
Work security	30	31.6
Financial aid	3	3.2
Mechanization	4	4.2
<b>Total</b>	<b>95</b>	<b>100</b>

**Table 9. Miners starting capital in NMF.**

Range in XAF	Frequency	Percentage
Not certain	60	63.2
<100000	20	21.1
[100,000–200,000]	8	8.4
[200,000–400,000]	3	3.2
[400,000–800,000]	3	3.2
>800,000	1	1.1
<b>Total</b>	<b>95</b>	<b>100</b>

mining is their best livelihood strategy, so respecting the law will mean they should stop mining, which they cannot do because they have families to feed and children to send to school among many other responsibilities.

Miners were asked what difference their activity will have if they had mining permits or authorizations to carry out mining. About 41% of miners replied that it would make no difference at all to them because they are working without papers. A fifth of them (20%) said if they had papers it would enable them to move freely and travel with their gold out of the locality and sell it at better prices; 31.6% others said it would permit them to ask for financial aid (Table 8).

#### 4.4 Financing and revenue

Analysis of field data revealed that 73.7% of miners in NMF personally funded their mining activities. A total of 24.2% of miners said private sponsors were sponsoring them and 2.1% took out loans to finance their activities. When miners take out loans,

**Table 10. Number of trips made by miner to the market per month.**

Number of trips	Frequency	Percentage
Not recalled	14	14.7
1	30	31.6
2	19	20.0
3	11	11.6
4	20	21.1
5	1	1.1
<b>Total</b>	<b>95</b>	<b>100</b>

they pay them back with an equivalent gold quantity proportional to the amount loaned. Their creditors are generally entrepreneurs or collectors who give them loans on condition that they buy the entire gold produced. Loans are generally given on a no-interest rate but the debtors are always taxed with high penalties of up to 50% and above if they fail to honor their obligations.

A large percentage (63.2%) of miners could not recall the amount of capital they started with. Miners need a minimum of XAF 218,000 to purchase the necessary working materials (Table 9). Further enquiries showed that they had only a few working tools when they started mining. Miners find it difficult to recall the capital they invest because they do not keep accounts of their finances. Some miners at times do not know whether they are making a profit or not. Only one miner invested up to XAF 800,000 as capital.

A total of 14.7% of miners could not recall the number of trips they made to the market in each month. The number of trips miners made to the market varied between 1 and 5 trips per month (Table 10).

Miners make a minimum profit of XAF 80,000 and a maximum profit of XAF 800,000 a month. Artisanal mining is carried out without prior prospection and so profit is not determined by the amount of money invested. Miners say it is a matter of luck. There were cases where miners invested less than XAF 50,000 in a hole and made a profit of XAF 1,000,000, while others invested huge sums of money and lost all. Cost of investment other than working materials is money spent on fuel, food, maintenance of motorized pumps and labor cost.

**Table 11. Change in miners profit within the last two years**

	Reasons for change	Frequency	Percentage
<b>Decrease</b>	Increase in expenditure	6	6.3
	Fall in gold prices	44	45.3
	Total	50	51.6
<b>Increase</b>	Hard work	1	1.1
	New techniques	2	2.1
	Increase in gold prices	24	26.3
	Experience in mining	18	18.9
	Total	45	48.4
	<b>TOTAL</b>		95

About half (51.6%) of miners said their profit within the last two years had decreased. This could be because gold experienced its lowest prices within the last three years in 2013. Almost half (48.4%) of miners said their profits have been increasing due to their hard work, experience in mining and increase in prices (Table 11).

The majority (72.5%) of miners said they were satisfied with the income earned from mining and 27.5% were not satisfied. Many of those who were not satisfied with income from mining were people who were not working in mining on a full-time basis. They were farmers, traders or people who carried out mining to substitute and complement income from other sources.

#### 4.5 Functioning of the market

The majority (83.2%) of miners in NMFM sell their products to individual collectors. Only 15.8% of miners sell to CAPAM agents. CAPAM fixes the official price of gold to be received by artisanal miners. These prices are fixed, taking into consideration the carat of the gold, the price on the world market in dollars and the percentage lost at smelting (Appendix 1). Collectors often offer higher prices compared to those offered by CAPAM. At the time when this study was conducted, CAPAM's price scale stood at 16,500 per g and 17,000 per g for collectors in Mintom. Miners generally do not have any bargaining power. It is generally a must-take price from both collectors and CAPAM.

The price of gold has tremendously increased within the last 10 years – from XAF 4500 per gram in 2003, to XAF 17,000 in 2013, which is an increase of

377%. All miners said the situation is better today than before, with the exception of too many price fluctuations.

All miners reported that they did not pay taxes. CAPAM pays taxes together with other supplementary purchase charges. CAPAM pays 3% of the value of the gold it purchases as taxes, as stipulated by the legislation in place. The 3% is shared as follows: 50% to the public treasury, 15% to the local council, 10% to the local residents and 25% for the follow-up commission.

#### 4.6 Secondary activities

When asked if they engaged in income generating activities other than mining, 52.6% of miners answered that they carried out only mining. Almost half (47.4%) carried out other activities apart from mining. Only two people carried out more than one activity besides mining (Table 10).

Among the activities mentioned, miners preferred agriculture 20%, fishing 7.4%, portorage 7.4%, and only 1 person collected NTFPs (Table 10). The people have long practiced traditional activities such as agriculture, farming, hunting, fishing and the collection of NTFPs. Today mining has led to intensification in the practice of some of these activities and led to the birth of new ones such as portorage and new forms of businesses.

Miners cite several reasons why they prefer one particular activity to the other. Those who practiced only mining said they preferred mining because it generated more revenue. Miners said they chose to invest in agriculture because it provides better



**Table 12. Alternative activities practiced alongside mining by miners in NMFM**

Activity	Frequency	Percentage
Only mining	50	52.6
Farming	19	20.0
Fishing	7	7.4
Porterage	7	7.4
Business	5	5.3
Hunting	4	4.3
Fishing and farming	2	2.1
NTFPs	1	1.1
<b>Total</b>	<b>95</b>	<b>100</b>

security at retirement, especially cocoa farming, since mining is a labor intensive activity and cannot be practiced after a certain age. Mining is not only beneficial to miners, because it leads to the creation of several other income-generating activities in the NMFM. These activities depend on mining for their survival.

#### 4.6.1 Agriculture

Although not directly resulting from mining, agriculture is accentuated and intensified with income from mining. Miners engaged in the cultivation of cocoa, plantains, cassava, maize, cocoyam, egusi (*Citrullus lanatus*) and groundnuts (*Arachis hypogaea*). Some miners who had been

farmers before starting mining said they have increased their farm sizes with money earned from mining. This was particularly true for farmers who cultivated cocoa and plantains because they need large farm sizes. Women practice farming around mining camps. A variety of local vegetables is cultivated inside mining camps. Farming around the camps is primarily for consumption. Produce from these farms are sold in rare cases. A mother who practiced vegetable farming in Boule d'or said she usually sells vegetables for up to XAF 5000 a week when her farm produces well. This gives her an income of up to XAF 20,000 a month if she harvests every week. Farming is mostly practiced in camps of up to 3 years of age. In such camps plantains, cassava and cocoyam are cultivated. In recent camps, vegetables are the only crops that are cultivated.

#### 4.6.2 Porterage

Porterage has emerged as one of the leading activities resulting from mining. Portering has emerged because of mines being several kilometers inside the forest and the poor condition of forest footpaths. Miners and traders need to carry their tools, goods and personal belongings to the mines so they make use of the services of porters. Porters carry goods either on their heads or in special baskets on their backs weaved out of rattan (Photo 2). In every camp there is a storage point where traders and miners pack and store their goods and they instruct their porters to pick up their goods from there and transport them to the mine. It was very difficult to get an estimate of the number of porters in each camp sampled because



**Photo 2. Porterage and fishing in NMFM.**

**Table 13. Commodity and cost of portering in three mining camps in NMFM.**

	Boule d'or	Zambata	Paradis terrestre
Estimated distance in km	8	11	17
Time needed to cover distance on foot	1 hour	1 hour 20 minutes	2 hours
Commodity cost of transportation to the camp (in XAF)			
1 bag of rice (50 kg)	4,000	5,000	10,000
1 bag of flour (50 kg)	4,000	5,000	10,000
1 crate of beer	1,500	1,500	1,500
½ dozen bottles of mineral water (1.5 l each)	750	1,000	1,000
50 kg cassava	6,000	6,500	10,000
1 dozen bottles of vegetable oil (1 l a bottle)	2,000	2,000	2,500
20 l of fuel	2,000	2,000	2,500
1 bunch of plantain (20 kg)	1,000	1,500	2,500

portering is not a regular activity. A focus group discussion was held with nine porters at Boule d'or. Porters' ages ranged between 16 and 33 years. They can carry loads of up to 50 kg. Transport rates are not determined in kilometers but by the time needed to cover the distance from the storage point on foot, the weight of the commodity and the condition of the road to the mine in question (Table 13).

Some porters earn up to XAF 20,000 a day. Porters' average monthly income was obtained by calculating the average between the highest and lowest income they make each month. Porters make an average of XAF 150,000 a month. Porterage was not a regular activity for most of the porters who were interviewed. Those who practiced portering alongside mining said they do it to increase their income and portering is not a permanent activity. All porters, including those who practiced mining, said it earned them more revenue than mining. They said the job was more tedious than mining but had the advantage of not being practiced every day. Porterage depends on the intensity of activity at the mine. The activities practiced inside mining camps depend on each other, with mining being the pivot and engine to all. When mining stops, all other activities die down too.

#### 4.6.3 Catering (restaurants)

One of the most lucrative activities resulting from mining is catering. The restaurant business has attracted many women who have settled in mining camps. Small restaurants are set up in the camps and

supply inhabitants with breakfast, lunch and supper. The activity is not limited to women alone because men were observed helping their wives by splitting fuelwood and butchering. Men carried out different forms of catering activities such as bread baking, as was the case in Boule d'or where an artisanal bread oven was built to supply the settlement and other surrounding camps with bread. Mining leads to the development of secondary activities within mining camps and in villages and towns around the mining camps. In Mintom for example, a big artisanal bakery was built to meet the high demand for bread by the fast-growing population in the town and in mining camps around the subdivision. The minimum cost for a plate of food in the mining camps surveyed was XAF 500. During periods of food scarcity inside mining camps, a single plate of food usually sells for up to XAF 1500. Bushmeat served with a variety of tubers such as cocoyam, cassava and rice was the most common food sold in camps. Restaurant owners served food to miners, traders and other inhabitants in the camps on credit and they paid either at the end of the month or after doing washing. Just like mining, the restaurant business attracts people from all over the country "We would not be here if our business was not profitable", a 43-year-old woman from the central region who owned a restaurant in Cool mining camp answered when asked if she was making any profits. She said she buys an aquatic chevrotain (*Hyemoschus aquaticus*) between XAF 6000 and XAF 10,000 depending on its size, and retails it to make profits of up to XAF 15,000. She said when activities are good she can sell up to six of them a month, giving her a

monthly profit of XAF 90,000. This together with the sales of other commodities, she said she could make profits of up to XAF 150,000. The profits of any business in mining camps depends solely on gold production. The more gold is being produced, the more lucrative other activities are, and vice versa. It was difficult to determine the monthly income from most of the restaurant owners, as they were not willing to say what they earned. Some miners make deposits to restaurant owners and deductions are made each time the miner consumes anything, until the funds are exhausted.

#### 4.6.4 Hunting

Hunting is the oldest activity practiced by the forest people in Cameroon, notably by the Baka people. Mining activities have led to an intensification of hunting. Some miners practice hunting for personal consumption, others sell their catch but nobody depended exclusively on income from hunting. All bushmeat consumed in mining camps came from the surrounding forest and other mining camps. Hunting is done through trapping and a few miners use guns. Bushmeat is sold both in the camps and to traders who visit on a regular basis. A piece of smoked bushmeat between 3 to 5 kg is sold at between XAF 1500 and XAF 2000. Mining camps serve as contact and supply points for traders in bushmeat or other animal parts and poachers. Traders supply the bullets and in some cases guns, and the poachers do the rest.

#### 4.6.5 Fishing

Like hunting, fishing is an old activity in the NMFm, which has gained more impetus with the advent of mining. In carrying out mining, miners enlarge small ponds and put together all the conditions necessary for fish to proliferate. Species of fish caught include tilapia (*Oreochromis niloticus*) and mudfish (Photo 2).

Fishing is generally favorable during the dry season and is done with the line and net. Both men and women practice it. Collective fishing sessions are organized during the dry season between December and February. This is done by building a temporary dike around a selected pond to prevent the fish from swimming out. The pond has previously been tested and proved positive results. Water is bailed out of the pond and fish are picked up with the hands. Water bailing was done with *bate* in the past but today some people use motorized pumps. Miners who carry out fishing say they do it on off-days such as Sundays when they do not go to the mines. Some miners interviewed during a fishing session in Zambata (Photo 2) said they usually make up to XAF 30,000 a month during the dry season when there is an abundance of fish.

#### 4.6.6 Collection of NTFPs

The collection of NTFPs by indigenous people in the NMFm has always been for their own consumption. The influx of people from other parts of the country



Photo 3. Business activities in mining camps.



has greatly contributed to the commercialization of NTFPs, among other factors. Artisanal mining camps have also been the origin of the increase in demand for certain NTFPs such as moabi (*Baillonella toxisperma*), eru or okok (*Gnetum africanum*), njansang (*Ricinodendron heudelotii*), honey, caterpillars, etc. which are harvested mostly by the indigenous Baka people and sold in mining camps. These products are either consumed in the camps or bought by traders (who bring goods and sell them in camps) and sell them in towns such as Mintom, Djoum, Sangmelima and Ebolowa. Some traders in Boule d'or said traders from Yaoundé leave them with money to buy *Irvingia* and *Gnetum* which they collect every week to resell in Yaoundé.

#### 4.6.7 Petty trade

All of the mining camps surveyed had small markets with shops. Women owned about 80% of the businesses in the mining camps which sold foodstuffs such as cassava, cocoyam, smoked fish, vegetable oil, rice, sugar and flour and off-licences where alcohol is sold. The most common commodity consumed in all mining camps visited was beer. The rate of alcohol consumption among miners was very high. The price of certain commodities doubled in mining camps in comparison to that in the nearest town. A bottle of beer sold in Mintom at XAF 700 was sold in Mvan a camp situated 33 km away at XAF 1500. Commodities such as a sachet of whisky were sold at the same price of XAF 100 as in town. Shop owners and foodstuff dealers said the prices of things doubled in mining camps because of the cost of transportation. Some businesspersons said they settle inside mining camps to do business not because it was more profitable than in town but because they do not have to pay rent and taxes in mining camps. This increases their profit since their expenditures are reduced. Both men and women do business. Some of the women who did business were the wives of miners. Some were in the camps on their own. Some businesspersons were engaged in mining. They are entrepreneurs who invest and employ laborers to work for them for a daily payment or for a percentage of the profit.

#### 4.6.8 Use of income

Artisanal miners were questioned on the way they used their income. All miners used their income to meet at least three basic needs – food, clothing

and health. Income is also used to send children to school for those who had children and/or dependents under their care. Some miners from other parts of the country said they send money home to their relatives. A majority of miners, particularly those who were single, said they spent too much money on leisure activities such as alcohol, prostitutes and cigarettes. The rate of alcohol consumption in mining camps was very high. Porters reported that the highest commodity they portered was beer. Televisions, radios and mobile telephones are some of the things young miners like to purchase. Miners and others also spent revenue to purchase motorbikes. Two miners were reported to have bought cars with income from mining. Miners generally have a problem with managing their income as a large percentage of what they earned was spent on alcohol and prostitutes and there was less used for reinvestment or savings.

#### 4.6.9 Problems of artisanal mining in the NMFM

The majority of miners (70.5%) reported that no one interfered with their mining activities. A total of 26.3% of miners reported that they usually receive visits from law enforcement agents such as gendarmes and forest guards. “They tell us we do not have the right to carry out mining” miners said. Miners say they usually corrupt them by giving them money when they visit. The *chef de chantier* collects the money and every miner is forced to contribute. The law enforcement agents do not demand a specific amount of money so there is no fixed rate of contribution. Miners usually give a minimum of XAF 5000 and this can go up to XAF 50,000 depending on the situation in the camp. The *chef de chantier* at Boule d'or said they corrupt these agents to prevent them from closing down their mines. Just 3% of miners said villagers and *chef de chantiers* usually stop them from mining as they say they are mining on their land.

Miners also said they usually receive a visit from administrative authorities such as the mayor and or their assistants, but they never collect anything from them. At times miners reported that they give them gifts or money as a goodwill gesture.

#### 4.6.10 Health problems

Miners reported a series of health problems, notably body pains which is associated with the difficult nature, hard work and long hours which mining

requires. Skin diseases are very common among miners due to long hours spent in muddy water. Waterborne diseases are also a problem because of lack of potable drinking water in the mines (Table 14). Miners are also exposed to sexually transmitted diseases through use of the services of prostitutes. The open mines left behind by mining carry stagnant water, which are favorable breeding grounds for mosquitoes. Malaria caused by these mosquitoes is one of the diseases which affects artisanal miners.

#### 4.6.11 Occupational safety

Artisanal mining is generally characterized by a lack of occupational safety. When asked whether they usually have accidents in the course of mining, 49.5% of miners cited wounds from the sharp tools such as cutlasses, and spades that they use. Other accidents mentioned by miners included various dangers from falling trees and branches and soil collapse with the risk of covering them in soil. The risk of soil collapse was reported to be rare since holes generally do not exceed 2 m in depth. The remaining 40% reported that they have never had any accidents. Miners know that mining is a risky activity and some miners said they have witnessed deadly accidents in the past. Exposure to wild animal attacks is also a risk that miners reported they face every day. They do not take particular safety measures but rely on God's guidance for protection. The majority (92.5%) of miners said they do not take any particular safety majors to avoid accidents. A total of 7.5% take minor precautions at work such as wearing gloves and being cautious at work.

Only 20% of miners replied that they go to the nearest health center when asked how they treat themselves in case they fall sick in the mining camps. The remaining 80% said they practice self-medication. They consult and buy drugs from drug

**Table 14. Health problems faced by miners in NMFM**

Problems	Frequency	Percentage
No problem	23	24.2
Body pains	46	48.4
Rashes	9	9.5
Malaria	11	11.6
Stomach problems	6	6.3
<b>Total</b>	<b>95</b>	<b>100</b>

dealers who in many cases set up their businesses inside the mining camps. Some of the drug dealers open up small consultations rooms where they carry out consultations and even give injections and place drips on people in serious cases. A drug dealer in Boule d'or when interviewed said he had never received training in medicine or pharmacy; he uses his many years of experience as a drug dealer to detect and diagnose diseases and give the appropriate treatment.

#### 4.6.12 Miners' vision about government support in the NMFM

When asked about any form of support received, only 4% of miners surveyed said they have ever received support from government through CAPAM. Miners in NMFM said they have received spades, bates and motorized pumps. The motorized pumps are given to miners on condition that all they produce will be channeled to the CAPAM purchase office. "CAPAM organized us into common initiative groups (CIG) but they are not functional," some miners said. Some miners said CAPAM's support is discriminative because their agents give support only to those who sell gold to them. Those who acknowledged to have received aid said it had been done only once since the implantation of CAPAM in the region.

**Table 15. Miners vision on possible government support to the artisanal mining sector.**

Vision	Frequency	Percentage
No response	15	15.8
Bring in mining companies which will provide jobs	6	6.3
Give financial support	3	3.3
Increase and stabilize price	12	12.6
Assist to get working materials	42	44.2
Reduce time and cost of obtaining mining permits	2	2.1
Carry out prospection and show better deposits	13	13.7
Provide social insurance for miners	2	2.1
<b>Total</b>	<b>95</b>	<b>100.0</b>



Miners' state that the possible form of support that the government could give to the artisanal mining sector is more assistance to get working materials (44.2%), which miners said is the biggest problem they face. Two miners said government should put in place mechanisms through which miners can personally pay their social insurance to ensure a better retirement, where they will receive pensions. A total of 13.7% of miners said government should carry out prospection and show them better deposits to mine, to improve their production and avoid haphazard exploitation and destruction of the forest.

## 4.7 Environmental impacts of artisanal gold mining in the NMFM

In the NMFM, 75% miners stated that mining has no negative impact on the environment when asked their opinion on the effects of their activity on the environment. These denials could be either because miners did not understand what was meant by impacts on the environment or because of fears of being accused and persecuted for destroying the environment. The majority (92%) of miners are aware they were working illegally.

The 25% of miners aware of the negative impacts of mining on the environment cited a number of impacts they have noticed, notably destruction of the soil and deforestation.

### 4.7.1 Destruction of forest swamps, diversion and pollution of river courses

Observed impacts included diversion and sedimentation of some rivers. All mining camps surveyed practiced alluvial mining. Miners carry out mining in forest swamp areas, diverted river courses and mines in the diverted riverbeds. Forest swamps have high biological diversity and constitute complex ecosystems. They play several roles in maintaining the equilibrium of forest ecosystems in terms of: groundwater recharge and discharge, flood control, sediment and toxicant retention, nutrient retention, biomass export, wildlife resources, fisheries resources and water supply (Dugan 1990). The disruption of this equilibrium will have huge environmental consequences, notably the destruction of the habitat of some animals such as the water chevrotain (*Hyemoschus aquaticus*) that lives in these

forest swamps and has an declining population due to hunting.

Mining in general produces huge quantities of mud and sand. This mud is transported downstream and leads to the sedimentation of rivers, and causes forest marsh floods, which is harmful to fish.

Oil waste and fuel from motorized pumps is disposed of in watercourses and this adversely affect the environment for animal, plant life and quality of water. It is likely to affect human life as most streams and rivers where surrounding village populations collect water pass through these forest swamps. A continuous increase in the number of mining camps and the number of miners will eventually increase the environmental risks.

### 4.7.2 Open mines

One of the main effects of artisanal mining on the environment in the NMFM is soil degradation and land damage. Miners do not refill the holes they make after mining. Pits lengths, widths and depths are 4, 3 and 2 m on average, respectively. Abandoned after mining, these open mines become traps for animals and breeding grounds for mosquitoes. No plants can grow around the area.

### 4.7.3 Impacts on wildlife

Poaching activities in the NMFM show that hunters are covering longer distances into the forest from their village – up to 30 km in places (Nzooh 2003). Bushmeat constitutes the highest source of animal protein intake in mining camps. An increase in the mining population leads to an increase in the demand for bushmeat and with demand from outside the camps, poaching is becoming more popular. The creation of mining camps inside the forest provides poachers with contact points. These poachers hunt protected species because of their high economic value. Miners reported cases of poachers who live inside mining camps but carry out hunting in Obac and Mvan mining camps. Several cases of hunters intercepted with protected animal parts from mining camps notably the gorilla (Photo 4), ivory (elephant) and giant pangolin scales have been reported. The proliferation of mining camps reduces animal habitat. The presence of human activities inside the forest has an impact on animal behavior. Miners reported cases



Photo 4. Gorilla parts hunted in the NMFM.



Photo 5. Logging activities and sedimentation of a river course in NMFM.

of chimpanzees that came to feed on waste around mining camps at night.

#### 4.7.4 Impacts on the forest

Miners cut down the forest in and around mining camps to have larger mining surface areas, and for the purpose of safety. Miners reported that 10 years ago they felled these trees with axes but today they

use chainsaws. With the use of chainsaws, miners fell a bigger number of trees thereby reducing surfaces covered by forest. The opening of artisanal gold mines creates roads and paves the way for small-scale logging as was observed in the Obac mining camp (Photo 5). These small-scale logging activities are gradually attracting more and more people. The impacts of mining coupled with that of logging is a serious threat to the forest.

# 5. Conclusion

The results of this study on the impacts of artisanal gold mining on local livelihoods and the environment in the NMFm revealed that 84% of miners surveyed were of Cameroonian nationality and 16% were from other African countries. The mining population in NMFm is continuously increasing, with more people coming from different regions and countries to mine. Mining attracts more youths, with 75% of miners aged between 15 and 35 years.

Mining is a lucrative activity. Miners earn relatively high incomes in shorter time periods compared to any other activity in the region. The standards of living of miners has increased because of income from mining. Miners earn a minimum of XAF 80,000 and a maximum of XAF 800,000 a month. Miners meet at least three of their basic needs with income from mining. Basic needs met included food, health, clothing, shelter and education. Mining is the best choice for artisanal miners since there is no restriction to entry, no taxes paid and revenue is immediate, contrary to other activities such as agriculture. The economic benefits of artisanal gold mining in the NMFm is quite considerable, with the proliferation of many business activities both inside mining camps and in villages. It leads to the creation of many other activities such as portering, catering and the intensification of others such as hunting, collection of NTFPs, and fishing. Miners remain poor due to poor revenue management.

This study shows that mining is a risky business for artisans because they mine through trial and error and so there is no certainty of production or profit. Mining camps do not last long and even when they do, production tends to reduce drastically over time.

Mining has some negative social impacts on the population as it leads to the development of activities such as prostitution which spreads of STDS including HIV/AIDS. Many children drop out of school to join mining, with children as young as 15 engaged in mining. Hygienic conditions inside mining camps are deplorable and lack of clean drinking water causes outbreaks of waterborne diseases. The long distances between the

mining camps and villages reduce the miners' access to healthcare.

In terms of environmental impacts, 75% of miners interviewed reported that mining had no negative impact on the environment and the remaining 25% cited impacts such as open mines and deforestation. We observed impacts such as the destruction of fragile forest ecosystems such as forest swamps; diversion; sedimentation and pollution of river courses; and soil destruction. The presence of artisanal miners inside the forest aggravates activities such as poaching, with the killing of endangered species such as gorillas and elephants. Miners fell trees on considerable surfaces of land in order to mine and build up settlements inside the forest. The environmental impacts of artisanal gold mining and the secondary activities it generates in the NMFm are still on a small-scale but will have adverse effects if mining activities continue to gain ground.

## Key recommendations

1. Put in place follow-ups to check environmental friendly mining practices and sanctions imposed on defaulters. Reduction in taxes or compensation can be given to those who carry out the best practices. This will encourage many more to follow suit.
2. Improve miners livelihoods by
  - teaching sustainable mining techniques to mitigate the negative environmental effects that mining generates;
  - giving them technical assistance by carrying out prospecting and allocating zones for artisanal mining activities;
  - giving miners the chance to benefit from social insurance to secure their retirement;
  - creating forums where miners are taught financial management and diversification of their activities that can lead to some miners leaving mining and taking up an alternative activity.
3. Facilitate procedures for obtaining artisanal mining permits. This will lead to a formalization of the sector and regularize many miners.



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# Appendices

## Appendix 1. CAPAM gold price scale

PROPOSED PRICE SCALE FOR CANALISING GOLD IN CAPAM'S MINING BRIGADES (November 2013)

DOLLARS 500 31.1034 ONCED'OR  
 COURS 1,350  
 COURS EN XAF 675,000  
 OR 24 CARATS 21,701

	1	2	3	4	5	6	7	8	9		
Mining district	Estimated gold carat for the mining brigade	International carat price for the site (2)= International price for 24 carats * average rating for the site / 24hr	percentage lost at smelting for the site (%)	Canalisation price in XAF/ gram: VCM to be perceived by artisans according to the above table	Canalisation price of gold/ gram: VCM to be perceived by artisans in the mining brigade (district)	Total charges at canalisation for the site (6)=(5,22%)*(5)	Ad valorem tax (7)= (3%)*(5)	Value lost at smelting	Cost in XAF/ gram all charges comprised (8) = (5)+(6) +(7)+(8)		
<b>Betaré-Oya</b>	Mali	Alluvial	21.97	19,865	11	15,375	15,000	783	450	1722	17,955
	Mobilong	Alluvial	21.97	19,865	7	15,375	15,000	783	450	1095	17,328
<b>Ndélélé</b>	GariGombo	Alluvial	21.24	19,205	8	15,242	15,000	783	450	1242	17,475
	Kika	Alluvial	23.05	20,842	7	16,703	16,500	861	495	1165	19,021
<b>Kentzou</b>	Vile/Bikala/ Ndoua	Alluvial	23.36	21,122	6	17,122	17,000	887	510	959	19,356
	Toko/Abieté	Alluvial	23.15	20,932	5	17,057	17,000	887	510	850	19,247
Yokadouma	Bite	Alluvial	23.47	21,221	6	17,111	17,000	887	510	1071	19,468
	Minto	Alluvial	23.6	21,339	7	17,110	17,000	887	510	1190	19,587
<b>Bipindi/ Iolodorf</b>	Messack	Alluvial	23.6	21,339	5	17,388	17,000	887	510	850	19,247

	1	2	3	4	5	6	7	8	9		
Mining district	Estimated gold carat for the mining brigade	International carat price for the site (2)= International price for 24 carats * average rating for the site / 24hr	percentage lost at smelting for the site (%)	Canalisation price in XAF/ gram: VCM to be perceived by artisans according to the above table	Canalisation price of gold/ gram: VCM to be perceived by artisans in the mining brigade (district)	Total charges at canalisation for the site (6)=(5,22%)*(5)	Ad valorem tax (7) = (3%)*(5)	Value lost at smelting	Cost in XAF/ gram all charges comprised (8) = (5)+(6) + (7)+(8)		
<b>Akom II</b>	kye-ssi	Alluvial	23.5	21,248	7	<b>17,037</b>	<b>17,000</b>	887	510	1190	19,587
<b>Mintom</b>	biwong	Alluvial	23.63	21,366	6	<b>17,270</b>	<b>17,000</b>	887	510	1020	19,417
<b>Ebolowa</b>	Dick/douala	Alluvial	23.8	21,520	3	<b>17,826</b>	<b>17,500</b>	914	525	525	19,464
<b>Sangmelima</b>	Ngouri-bari	Alluvial	16.5	14,919	30	<b>10,100</b>	<b>10,000</b>	522	300	3000	13,822
<b>Ambam</b>	Leggalgoro	Quarry	17.17	15,525	30	<b>10,483</b>	<b>10,500</b>	548	315	3190	14,553
<b>Biwongbulu</b>		Quarry	15.74	14,232	31	<b>9,586</b>	<b>9,500</b>	496	285	2920	
<b>Mvangan</b>	KomboLaka	Alluvial	22.38	20,236	11	<b>15,733</b>	<b>15,500</b>	809	465	1690	18,464
	Vaimba	Quarry	19	17,179	20	<b>12,474</b>	<b>12,500</b>	653	375	2500	16,028
<b>Tcholliré</b>	Sinassi	Alluvial	22.02	19,910	12	<b>15,348</b>	<b>15,000</b>	783	450	1800	18,033

Cours international au titre concerné = VCM+VCM\*3%+VCM\*Taux perte+VCM\*5,72%+VCM\*4%+VCM\*5%

Rey Bouba

VCM= cours international au titre concerné/ (1,1772+ taux de perte)

VCM\*3%= taxe Ad Valorem

VCM\*5;22%= charges préalables d'appui à la canalisation

**FORMULE DE CALCUL:**

## Appendix 2. Research questionnaire

### Research Questionnaire

This questionnaire is destined to trace the evolution, functioning, organization and problems of artisanal gold mining in the forested areas of Cameroon. Please feel free to express your feelings and ideas. Your contribution may go a long way to providing long lasting solutions to impending problems and lead to better and sustainable management of natural resources.

*(Please answer all questions and mark with an x where necessary)*

#### I. Biodata of respondent

Names: \_\_\_\_\_

Age: \_\_\_\_\_

Sex:  Male  Female

Nationality \_\_\_\_\_

Division of origin \_\_\_\_\_

Ethnic group \_\_\_\_\_

Village \_\_\_\_\_

Level of education (state highest class attended) \_\_\_\_\_

Profession before mining \_\_\_\_\_

Matrimonial status: Single  Married (polygamy or monogamy)  Widow/Widower

Number of wives if more than one \_\_\_\_\_

Number of children \_\_\_\_\_

#### II. Mining activities

1. In which mine do you work? \_\_\_\_\_

2. How old is the mine? \_\_\_\_\_

3. Is mining your principal activity? Yes  No

4. In average, what is the life span of a mine? \_\_\_\_\_

5. For how long have you been carrying out mining \_\_\_\_\_

6. How did you join this activity \_\_\_\_\_

7. Do you own your own hole? Yes  No

8. How many people work with you (total workforce) \_\_\_\_\_

Family members

Hired labor

Men

Women

Children less than 15

9. How do you remunerate those working with you?  
 Daily payment  Weekly  Monthly  Percentage of production with gravel

10. Which techniques do you use in mining? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (explain)

11. Has this or these techniques changed over the years. Yes  No

12. If yes, what has changed and why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. List the different tools you use in your work and the unit cost of each;

Hand tools	Machines

14. How do you process your gold? \_\_\_\_\_

\_\_\_\_\_ (explain)

15. How many grams do you produce per day/week?

16. Other than gold which other mineral do you mine?

17. Do you use any chemicals in the process of mining? Yes  No

18. If "Yes" which chemicals do you use? \_\_\_\_\_

19. Do you have legal papers authorizing you to carry out mining? Yes  No

20. If yes how did you obtain them? \_\_\_\_\_

21. How much do you spend to obtain these papers? \_\_\_\_\_

22. Are you aware there are laws governing mining in the country? \_\_\_\_\_

23. Do you respect these laws? \_\_\_\_\_

24. What do you think about these laws? \_\_\_\_\_

\_\_\_\_\_

**III. Financing and revenue**

What is your source of capital? Personal funding  Private sponsors

Government support loan

25. If loan how do you pay back? \_\_\_\_\_

26. What was your capital when you started? \_\_\_\_\_

27. In what form do you sell your product? In form of gravel smelted  In crude form

28. How many trips do you make to the market a month? \_\_\_\_\_

29. How much profit can you make from each sale? \_\_\_\_\_

30. Over the last 2 years has your profit, 1) increased  or 2) decreased?

31. What are the reasons for the increase/decrease in the profits you make?

\_\_\_\_\_

\_\_\_\_\_



#### IV. Functioning of the market

1. To whom do you sell your gold
  - 1) Collectors
  - 2) Sponsors
  - 3) CAPAM offices
  - 4) Other purchase institutions
2. What is the current unit price at which you sell? \_\_\_\_\_
3. What was the price? 5 years ago \_\_\_\_\_; 10 years ago; \_\_\_\_\_ 15 years ago \_\_\_\_\_.
4. How is the situation compared to the past 1 = better; 2 = worse; 3 = the same
5. How do you get your products to the market \_\_\_\_\_  
\_\_\_\_\_
6. How do you sell your product? Individually  Family  GICAMINE
7. Do you pay any tax? \_\_\_\_\_  
7.1) if yes what type of tax do you pay? \_\_\_\_\_

#### V. Secondary activities

1. Other than mining do you practice or carry out other activities Yes  No
2. If yes what other activity do you practice; (*tick from the list below and specify the type e.g. Types of farming and crops grown or types of NTFPs harvested or animals hunted*)
  - a. Hunting
  - b. Farming
  - c. Livestock rearing
  - d. NTFPs
  - e. Fishing
  - f. Trading
  - g. Others (specify)
3. How much do you earn weekly \_\_\_\_\_; monthly \_\_\_\_\_ from your secondary activities?
4. Which activity do you prefer mining or you other activities? \_\_\_\_\_
5. Give reasons for your choice \_\_\_\_\_  
\_\_\_\_\_

**VI. Livelihoods and management of revenue**

1. Do you live in the mines where you work? Yes  No
2. How do you spend the money you earn? Specify the proportion of revenue you spend on the following:
  - a. Buy food
  - b. Buy clothes
  - c. Health
  - d. Send children to school
  - e. Build houses
  - f. Send money to relatives
  - g. Beer and other forms of alcohol
  - h. Cigarettes
  - i. Others (specify)
3. How many dependents are under your care? \_\_\_\_\_
4. Do all your children go to school?
5. How else do you use the revenue you earn? \_\_\_\_\_

**VII. Problems associated with mining and its activities**

1. Does anybody ever disturb you from mining? Yes  No
2. If “yes” who are those who disturb you?
3. What are the health problems you are faced with? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Do you usually have accidents? If “yes” name some of the accidents you usually have. \_\_\_\_\_  
\_\_\_\_\_
5. How do you protect yourselves from these accidents? \_\_\_\_\_  
\_\_\_\_\_

6. Do you have access to medical care? \_\_\_\_\_
7. If “No” how do you treat yourselves when sick? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. What do you think government can do to improve the artisanal mining sector and the livelihood of miners?  
\_\_\_\_\_  
\_\_\_\_\_

### VIII. Impacts on the forest environment

1. According to you does mining have a negative effect on the environment? \_\_\_\_\_
2. If “Yes” please list some of the effects you have observed \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. How have you been managing this negative effects \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. What do you do to protect the forest environment from the negative effects from mining? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. Do you think gold will one day get exhausted from the subsoil? Yes  No
6. If “Yes” to question 7 how do you intend to live then? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
7. Is there any other information you would like to share with me today?





**CIFOR Working Papers** contain preliminary or advance research results on tropical forest issues that need to be published in a timely manner to inform and promote discussion. This content has been internally reviewed but has not undergone external peer review.

This study assesses the impact of artisanal gold mining in the Ngoyla-Mintom Forest Massif (NMF) on local livelihoods and the environment. The methodology for the research consisted in a literature review, visits to eight mining camps in the periphery of Mintom, interviews with 95 miners, focus group discussions with actors involved in activities related to gold mining, and stakeholder consultations. The results show that miners earn a minimum of XAF 80,000 (US\$ 160) per month, which is about three times the average wage in Cameroon (XAF 28,216 or US\$56) and as much as XAF 800,000 (US\$ 1600) a month. Mining leads to the creation of many associated activities such as portering, catering and the intensification of hunting, collection of NTFPs, and fishing, among others. The most negative social impact of mining is associated with activities such as prostitution, which leads to the quick spread of sexually transmitted diseases (STDs) including HIV/AIDS. Mining and its associated activities also have negative impacts on the environment such as destruction of fragile forest ecosystems especially swamps, diversion, sedimentation and pollution of small water ways, and soil destruction, although at a relatively small scale.



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