HUMANIDADES E CIÊNCIAS SOCIAIS:

Perspectivas Teóricas, Metodológicas e de Investigação

Luis Fernando González-Beltrán
(organizador)

EDITORA ARTEMIS
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PRÓLOGO

Como la obra “Humanidades e Ciências Sociais: Perspectivas Teóricas, Metodológicas e de Investigação”, ha tenido gran éxito, nos complace presentar el Volumen 6. Si, ya son 6, y aquí tenemos 18 capítulos en tres secciones, donde agrupamos las investigaciones sobre Humanidades y Ciencias Sociales que abarcan la Educación, las problemáticas Sociales, y las empresas.

En el apartado que llamamos “Educación: Investigación y Nuevas tecnologías” incluimos 8 capítulos que abarcan desde la Educación Básica hasta la Universitaria, desde nuevas tecnologías, como las redes sociales, pasando por la enseñanza híbrida, hasta la Inteligencia Artificial. Como el nombre lo indica, son tecnologías nuevas, por lo que no se han establecido aún parámetros de normalidad con fines de comparación. Cuales tecnologías son más efectivas que otras, cuando se deben aplicar solas, y cuando en combinación. De esta forma, cada estudio que se realiza agrega un granito de arena al vasto océano del conocimiento. Iniciamos revisando la primaria rural, donde se propone que la Interculturalidad puede romper la desigualdad, la exclusión y la dominancia, resolver los conflictos y las tensiones en las perspectivas de vida, sus cosmovisiones y sus saberes. En el segundo capítulo se estudian las redes sociales y su posible efecto sobre las habilidades sociales. A continuación se ensaya la modalidad híbrida en la formación técnica y tecnológica, con mayor éxito, logrando un perfil óptimo. En cuarto lugar se utiliza un sistema digital de Enseñanza Aprendizaje, con Inteligencia Artificial, para traducir texto a lenguaje de señas y realizar la traducción en sentido inverso, mejorando la comunicación bidireccional. Esto representó un proceso de retroalimentación personalizada, y de forma inclusiva y equitativa. Seguimos con la medición del perfil agentivo en universitarios, midiendo el logro de metas y el aprendizaje colaborativo. Conforme los alumnos avanzan en los semestres, aumenta su percepción de agencia colectiva. Continuamos con la revisión de la técnica de observación de las prácticas educativas, como procedimiento metodológico de investigación, su interconexión, triangulación y procesamiento de datos. Incluimos a continuación un trabajo sobre Inteligencia Artificial donde se tratan cuestiones éticas como su uso responsable. Se detalla su aplicabilidad, sus límites, sus impactos tanto positivos como negativos y sus verdaderos alcances. El apartado finaliza con un capítulo sobre la práctica en el trabajo social. Proporciona ejemplos prácticos de estrategias y habilidades duras (técnicas) y blandas (comunicación, empatía).

En la segunda sección “Problemáticas Sociales y Ambientales” se ilustra un tema de actualidad, que incluye la posibilidad de desastre, de un camino sin retorno, como consecuencia del abuso de recursos que han provocado cambios climáticos, escases de agua y alimentos, incendios, inundaciones, pérdida de bosques y selvas, etcétera. Con 4 capítulos, esta sección trata de problemáticas analizadas para el caso de México, Colombia, Camerún, e Italia. Problemas comunes a una infinidad de países. Iniciamos con la certificación de Playas en Acapulco. Las playas son un recurso común, y aunque

los grandes hoteles se han apropiado de algunas, es un recurso de difícil exclusión, y la certificación, aunque necesaria, no es suficiente para la búsqueda de un turismo sustentable. Seguimos con la construcción de obras que responden a necesidades nacionales, pero que provocan problemas locales. Este caso corresponde a una repesa para generar energía, con fines de modernización y desarrollo, pero con consecuencias socioculturales en la comunidad donde se construyó. Como tercer trabajo tenemos el conflicto del uso del suelo, en específico, la minería contra la degradación del bosque. Oro y demás metales que pesan más en la balanza económica que el oxígeno y los alimentos. El cuarto y último capítulo de la sección trata de la estimación de eventos meteorológicos extremos, que son ahora más frecuentes por las malas decisiones que hemos tomado contra nuestro planeta. Como si tuviéramos recursos infinitos para depredar, las consecuencias de nuestros abusos se reflejan en un porcentaje de mayor peligro de incendios cada verano, pronosticados especialmente para Italia, pero que hemos sufrido en muchas otras partes del mundo.

El tercer apartado "Economía, Empresa y Gestión", con 6 capítulos, trata sobre la economía desde el caso de los particulares, a las pequeñas tiendas, a la relación entre Universidades y Empresas, pasando por las PYMES, las decisiones de inversión en empresas de mayor envergadura, y finalizando con el papel de la mujer en la economía. Iniciamos con una de las consecuencias económicas del COVID, el repunte de los pagos electrónicos, el cierre de las tiendas físicas, la educación digital, y la persistencia de la digitalización. Seguimos con las tiendas y su competencia y los desafíos que enfrentan contra las multinacionales. Se sugiere, entre otras estrategias, la cooperación entre las tiendas, mejorar el marketing, ajustar los precios, etcétera. El tercer capítulo presenta a las pequeñas y medianas empresas, con un débil vínculo con las Universidades, que no poya de manera clara la transformación empresarial, ni la gestión del conocimiento. La baja inversión en infraestructuras que impulsen la inteligencia empresarial impide ajustarse al orden global. Continuamos con un tema con íntima relación: la Cultura Organizacional, que debería impulsar en este sector, la gestión del conocimiento, las estrategias corporativas, estabilidad y armonía. El quinto capítulo habla del presupuesto de capital y las decisiones de inversión. Antes de la toma de decisiones tan crucial, las oportunidades de inversión deben clasificarse según los rendimientos esperados, y aquí se revisan diversas técnicas con dicho objetivo. La obra finaliza analizando el rol que la mujer juega no digamos en la economía, sino en toda la sociedad. Se revisa la obra de Soledad Acosta, prolífica escritora, periodista, historiadora, que reivindica la educación de las mujeres para construir una mejor sociedad.

Esperamos que este Volumen, además de muy completo, y muy variado, resulte también muy placentero en su lectura.

Dr. Luis Fernando González Beltrán
Universidad Nacional Autónoma de México (UNAM)

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Igor Casimir Njombissie Petcheu
Global Mapping and
Environmental Monitoring
Yaoundé-Cameroon

Mesmin Tchindjang
University of Yaoundé I
Faculty of Letters, Arts and
Social Sciences
Department of Geography
Yaoundé Cameroon
https://orcid.org/0000-0002-3129-1467

Eric Voundi
The University of Ebolowa
Department of Geography
Yaoundé-Cameroon

Philippes Mbevo Fendoung
The University of Douala
National Higher Technical School
Douala Cameroon
https://orcid.org/0000-0002-2701-5830

Unusa Haman
Ministry of Environment
Protection of Nature and Sustainable
Development
Yaoundé-Cameroon

Frédéric Saha
Global Mapping and
Environmental Monitoring
Yaoundé-Cameroon

ABSTRACT: Mining practices in Cameroon began since the colonial period. The artisanal mining sector before independence contributed to 11-20% of GDP. Also, Cameroonian forests have a long history from the colonial period to the present. The objective of this research in the Lom and Djérem division is to study, apart from the proliferation of mining licenses and actors, the dilemma as well as the impact of the extension of mining activities on the degradation of forest cover. First of all, we use geospatial tools through multi-temporal and multi sensor satellite images (Landsat from 1976 to 2015, IKONOS, GEOEYE, Google Earth) to map the dynamic of different forms of land use (mining permits, Forest management unit-FMU and protected areas of permanent forest estate) and highlighted paradoxically the conflict of land use. Secondly field investigations allow us to collect data on the number of permits and the main mining societies in the area. Since 2003, the rich potential of the Cameroonian subsoil attract many foreign investors with over 600 research and mining permits already granted during the last decade. Of the 160 licenses granted in the whole country, half are from the Eastern Region and Lom & Djérem

has 29 licenses straddling it territory. The number of companies holding exploration permits increased from just one in 2003 to more than 40 companies in the Eastern Region. As land use is concerned, we notice a decline of 60% of the forest while savanna is increasing. In this region devoted to conservation, totalling protected areas yields an area of 505,669.77ha (19.38 %), compared to 1,823,589.66 ha (69.89 %) of mining permits and there is the dilemma. We came to the conclusion that the rhythm of issuing mining permits and authorizations in this forestall zone is so fast that one can wonder whether one could still find a patch of forest within 50 years.
KEYWORDS: Bétaré-Oya. Deforestation. Dilemma. Lom & Djérem. Mining.

MAPEAMENTO DO DILEMA DA MINERAÇÃO CONTRA A FLORESTA E A CONSERVAÇÃO NA REGIÃO DE LOM E DJÉREM, CAMARÕES

RESUMO: As práticas de mineração nos Camarões começaram desde o período colonial. O sector mineiro artesanal antes da independência contribuiu para 11-20% do PIB. Além disso, as florestas camaronesas têm uma longa história desde o período colonial até o presente. O objectivo desta investigação na departamento de Lom e Djérem é estudar, para além da proliferação de licenças e actores mineiros, o dilema, bem como o impacto da extensão das actividades mineiras na degradação da cobertura florestal. Primeiramente, utilizamos ferramentas geoespaciais através de imagens de satélite multitemporais e multisensores (Landsat de 1976 a 2015, IKONOS, GEOEYE, Google Earth) para mapear a dinâmica das diferentes formas de uso do solo (licenças de mineração, Unidade de Manejo Florestal-UMF e áreas protegidas de propriedade florestal permanente) e destacou paradoxalmente o conflito de uso da terra. Em segundo lugar, as investigações de campo permitem-nos recolher dados sobre o número de licenças e as principais sociedades mineiras na área. Desde 2003, o rico potencial do subsolo camaronês atrai muitos investidores estrangeiros, com mais de 600 licenças de investigação e mineração já concedidas durante a última década. Das 160 licenças concedidas em todo o país, metade são da Região Leste e a Lom & Djérem departamento possui 29 licenças abrangendo o seu território. O número de empresas detentoras de licenças de exploração aumentou de apenas uma em 2003 para mais de 40 empresas na Região Leste. No que diz respeito ao uso da terra, notamos um declínio de 60% da floresta enquanto a savana aumenta. Nesta região dedicada à conservação, a soma das áreas protegidas rende uma área de 505.669,77ha (19,38%), em comparação com 1.823.589,66 ha (69,89%) de licenças de mineração e aí está o dilema. Chegamos à conclusão de que o ritmo de emissão de licenças e autorizações mineiras nesta zona florestal é tão rápido que podemos perguntar-nos se ainda conseguiremos encontrar uma mancha de floresta dentro de 50 anos.
PALAVRAS-CHAVE: Bétaré-Oya. Desmatamento. Dilema. Lom & Djérem. Mineração.

1 INTRODUCTION

Mining international context is characterized by a strong demand for minerals like gold, aluminum, cobalt, iron, diamond, etc. The provision of these is difficult to satisfy, due to political instability in the major producing countries (South Africa, Congo DRC,

India, Central African Republic, etc.). It rose up a dramatic rise in prices. As Cameroon is concerned, before independence, the artisanal mining sector contributed to 11-20% of GDP, nowadays, the mining sector only accounts for less 1% of Cameroon's GDP because of trafficking, misappropriation of production or poor governance. It should also be noted that the highly lucrative character of mining involves a preference for this activity at the expense of the sustainable management of communal and state forests.

Mining, which was very old in Cameroon, remained artisanal and marginal until the beginning of the 1990s, the date of the first attempts to organize the sector by the various actors. However, the mining circuit in Cameroon remains complex; both in terms of legal operating procedures and government statistics as well as in terms of production and especially the number of operators. In addition, this sector currently has two faces, a craft sector strongly implanted and in full effervescence, a modern sector that is still embryonic. In artisanal mining, it is estimated that more than 15,000 people are involved in this activity on a full-time basis. The government's efforts to organize this activity have resulted in the creation of the CAPAM (Support Framework for Mining Crafts) in 2003, whose tasks include: technical supervision of operators and channelling their production to formal frameworks. The modern sector, destined to develop within Cameroon's ambitions for development, aims to explore, exploit and transform deposits. CAPAM has been replaced by SONAMINES (National Society of Mines) in 2020 and it mission consisted to the development and promotion of the mining sector in Cameroon. The Eastern region, which is extremely rich in mineral resources, is subject to enormous greed from large operating companies. The same region is where industrial forestry concessions have been established the longest, resulting in conflicts and overlaps between Forest Management Units (FMUs), protected areas and mining permits.

At the beginning of the 3rd millennium in Cameroon, mining is at the centre of all issues and raises debates depending on whether one is an economist, a forester, an ecologist, an administrator or a conservator. Indeed, conservationists are seen as detractors whereas economists find a good source of income for the state and for the populations. To better understand this situation, we must start from the rapid spatial expansion of mining activity for about 15 years. Secondly, we must analyse the consequences of this development and the related controversies. Indeed, in the current literature, even in countries with a long tradition and experience in this field, social costs and environmental impacts are not always easily controlled. The role of remote sensing and GIS is crucial in this process, both in terms of quantitative assessment of the areas occupied and the land use in the areas of exploitation, but also in terms of ecological and socio-cultural impacts. Three main questions raised up: how to reconcile mines and

conservation of the Lom and Djérem forestall massifs? How to combat poverty and land conflicts emanating from this activity? How to sustainably exploit existing mines and forests by avoiding conflicts of land use?

Among the assumptions arising from this problem, we can note:

- The unbridled and uncontrolled development of artisanal mining and the negligent granting of exploration or mining permits which have a considerable impact on ecosystem fragmentation, forest degradation and deforestation. In addition, extractivism mortgages conservation.
- This development could, in the absence of integrated activities (agriculture and livestock farming), jeopardize food security (abandonment of food speculation for mines), affect the health of minors, increase poverty and loss of identity of indigenous peoples Due to the disappearance of the forest patrimony of which they have long been dependent and guarantor). There is a lack of zoning and a resurgence of conflicts.

The objective of this research in the Lom and Djérem is to study the environmental impact of the extension of mining activities on the degradation of forest cover outside of the multiplication of permits and actors. The assessment of this dynamics requires the superimposition of the various forms of land use (mining permits, FMUs and protected areas in the permanent forest domain) and the resulting conflicts over land use. Specifically, the study will:

- draw up a typology of mining permits and authorizations in the Department of Lom and Djérem;
- assess the impact of mining on degradation of forest cover in terms of degradation and reduction of forest area, loss of biodiversity, habitat fragmentation and impact on forest management;
- evaluate by diachronic mapping the forest dynamics linked to mining in terms of conversion of forest areas into mining fields through the clean cut of the forest and destruction of natural habitats;
- Studying the superimposition of mining permits and forest conservation areas; it is a question of evaluating by superimposed mapping the current status of the permits of exploitation and their geographical position in relation to the protected areas; Forests and forests.

The use of geospatial tools coupled with a careful field survey allowed us to monitor the evolution of permits and the development of these activities.

2 THE STUDY AREA

2.1 CAMEROON MINING CONTEXT

With just over 19 million hectares of dense rainforests, Cameroon is one of the four main forestall countries of the Congo Basin (Wasseige 2014). Its forest area covers about 42% of the national territory. It has a fairly large and diverse ecological and floristic potential with more than 600 species, 300 of which can be marketed in the form of timber, of which only 60 are currently exploited (FAO 2005). It contains one of the richest and most varied fauna of the continent (FAO 2005, MINEF 1993, Eba'a Atyi et al., 2013).

The forestry sector remains an important source of revenue for the Cameroonian government. The Forest Law of 1994 amended in 2009 introduced a framework setting the benefits for local communities. . In accordance with this law and subsequent regulations, 50% of the RFA goes to the treasury, 20% to the FEICOM, 20% to the local council and 10% to the local communities.

As in the forestry sector, Cameroon is a country with diverse and unequally distributed extractive resources throughout its national territory and attractive to investors. Since the publication of the Investor-Friendly Mining Code of 16 April 2001 (revised in 2010 and 2016), 167 exploration licenses and 5 mining permits have been issued for only 40% of the Cameroonian territory explored.

2.2 THE LOM & DJÉREM DIVISION

The target area studied is the Lom & Djérem, one of the four administrative divisions of the Eastern Region of Cameroon. This division with 08 districts (Garoua Boulaï, Bétaré Oya, Bélabo, Diang, Bertoua 1, Bertoua 2, Mandjou, Ngoura), hosted the Bélabo council forest, the Kobungunda protection forest and two protected areas: Mbam & Djerem and Deng-Deng National Parks. The Eastern Region of Cameroon covers an area of more than 109 002 km², which represented about 1/4 of the total Cameroon area. This region borders with the Central African Republic.

From a geomorphological point of view, the Lom & Djérem is part of the South Cameroon plateau with an altitude ranging from 600 to 900 m, built on geological formations rich in quartz, kaolinite, goethite and gibbsite (Kuété 1990). The entire landscape lay on a Precambrian plateau belonging to the Mbalmayo-Bengbis series (Gartlan 1989). The soils are ferralitic red, clayish, soft and permeable with little humus. A dense hydrographic network drains the Lom & Djérem. In fact, the two main rivers which form part of the Congo River basin throw themselves in the Sanaga.

The study area belongs to a warm and humid equatorial climate comprising 4 seasons; two rainy seasons that stretch from March to June and September to November, and two dry seasons from December to February and July to August. The average annual temperature is 24°C and annual rainfall is between 1,180 mm and 2,000 mm. The annual thermal amplitude between the hottest and coldest months is 2°C. Evapotranspiration is between 1,150 and 1,300 mm per year (Suchel, 1988).

The vegetation of Lom & Djérem is schematically broken down between the rain forest (most protected areas) and a forest-savanna mosaic (in the north). Within these two groups, there are different flora facies: semi-deciduous forests, secondary forests, gallery forests and swamp forests, grassy and wooded savannahs (Letouzey, 1985). The diversity of these habitats and the landscapes they make are potentially attractive to visitors. These ecosystems are all the more spectacular because they are crossed by large rivers (Lom, Pangar, Djérem and Sanaga rivers) with deep valleys, offering wide panoramas.

The forest is not only more preserved, but it is home of more "patrimonial" species; particularly the great apes (chimpanzees and gorillas). Other forest species likely to be encountered in the parks are: black colobus, bush pig, *hylocherus*, aquatic chevrotain, sitatunga, buffalo, etc. Although extensive inventories have not yet been carried out, avifauna, herpetofauna and entomofauna also seem to be of interest.

The Lom & Djérem has a population of 275 784 inhabitants, a density of 10.57 inhabitants per km² (BUCREP, 2010) which is one of the lowest in Cameroon. Populations tend to concentrate around urban centers, notably Bertoua and Bétaré Oya.

In this forest zone, climate and soil quality are favourable to subsistence farming (tubers, bananas, maize, etc.) and cash crops (robusta coffee, cocoa, palm, rubber, etc.). In the savannah zone, agriculture is mainly subsistence farming, which is a grazing area for herds and even transhumant coming from the more northerly regions. The Eastern Region is perceived as the Cameroonian El Dorado. The first attempts at mineral exploration date from the colonial period. Undoubtedly, gold is the first mineral discovered. From 1933 to 1942, about 717kg of this precious metal was pulled annually from the basement.

3 METHODOLOGY

Mining has become a very sensitive activity in the World and particularly in Cameroon at four levels: social, political, economic and environmental. Its social and environmental impacts are decried in many countries. It is for this reason that the methodology used has been broadly mixed and includes 5 complementary and integrated

steps, including documentary research, acquisition of satellite imagery, image processing, qualitative field observations and participatory surveys, data treatment Survey and their integration and combination with GIS. The 10 Landsat images (MSS, TM, ETM +, Landsat 8) and SRTM images were downloaded from Maryland's GLCF site. They are staggered from 1976 to 2015. The 16 SPOT images were provided to us directly by the GEOST team during on June 16th, 2015. Finally, IKONOS (2 images) and GEOEYE (6 images) coming from Digital Globe were purchased from the authorized distributor GEOCOM. The Bétaré-Oya Google Earth images were cut from the site and processed. If the Landsat images were complete, the SPOT images did not cover the entire Lom & Djérem.

In addition, we uploaded Google Earth images (10) that focus on Bétaré Oya and its outskirts as well as the Deng - Deng National Park. The Interactive Forest Atlas (version 3.0) edited by WRI & MINFOF (2013) was also consulted to view the permits before superimposing to other land use on GIS.

The processing and interpretation of the images thus acquired were organized in several stages and several integrated teams:

Pre-processing and application of filters to visualize and recognize targets. The difficulty here was the recognition of artisanal mining in the images. We were able to spot them along the rivers and a first team of 03 people was in charge of visualization and recognition. The opening and viewing of Google Earth images for different sectors has also been of great help, especially along the rivers, where gold extraction is alluvial.

A second team of 02 people worked on supervised image classification under ENVI 4.7 and ERDAS 2014. These classifications have enabled us to highlight dynamics and changes in land use; which we subsequently supplemented by fieldwork. In addition, the land cover area (Mosaic savanna forest, dense forests of high conservation value, secondary forest, savannahs, mines, etc.) was assessed. The layers thus obtained have been vectored and integrated into a GIS.

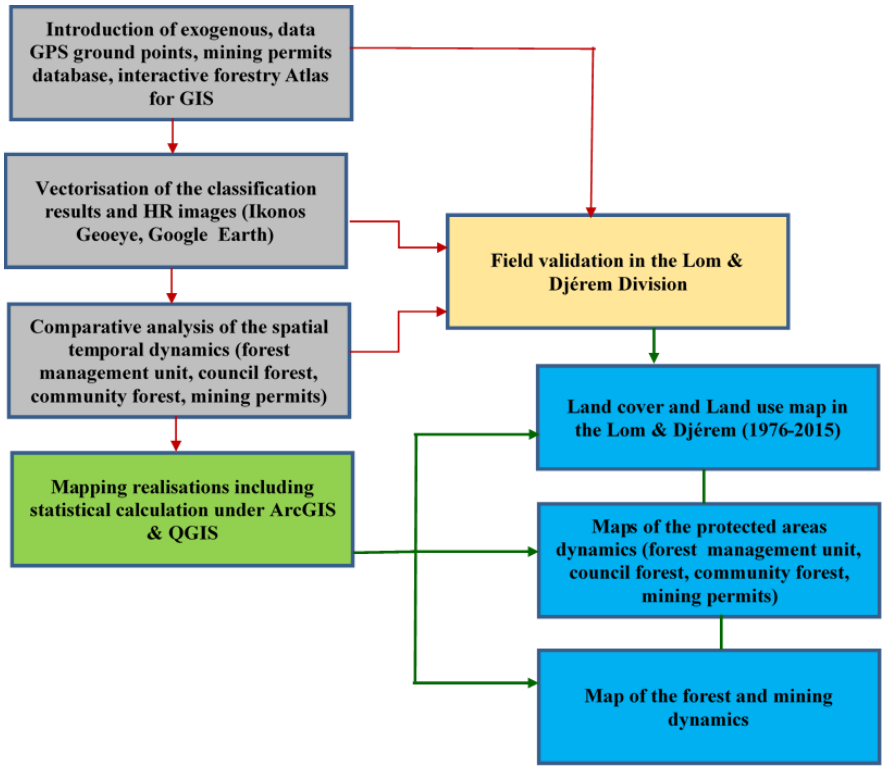
A third team of 02 people worked on ARCGIS10.0 and QGIS 2.8 digitization of very high resolution images (GEOEYE, IKONOS, and Google Earth). This has allowed not only to refine the areas but also to observe the attack of forest and forest conservation areas through artisanal mining. This has been very helpful in identifying land use conflicts.

The fourth team carried out the mosaicking of the treatments / classifications and the production of the synthesis maps by year on the land use dynamics in the Lom & Djérem division under ARCGIS 10.0 and QGIS 2.8 after integration of the collected data coming from the field survey.

In addition, mining permits and other exploration permits collected during the field surveys were entered under Excel. This database has been integrated into the GIS and

help to compare the areas proposed by the mining authorities with those obtained from the GIS on the basis of the corresponding geographical coordinates (figure 1).

Figure 1. Methodological flow chart.



We have detected many errors in the allocation of mining permits and licenses in Cameroon. This allocation appears to be based on the maps 1: 200 000, which is subject to enormous misunderstandings, overlap and multiple conflicts.

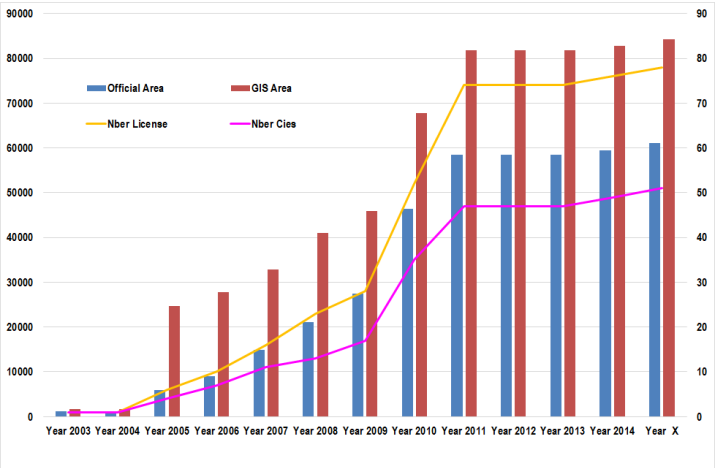
4 RESULTS AND INTERPRETATION

The results are presented in two subsections. The first one will deal with the evolution of mining licenses while the second concerns, the mapping of the land use dynamics.

4.1 EVOLUTION OF THE MINING PERMITS

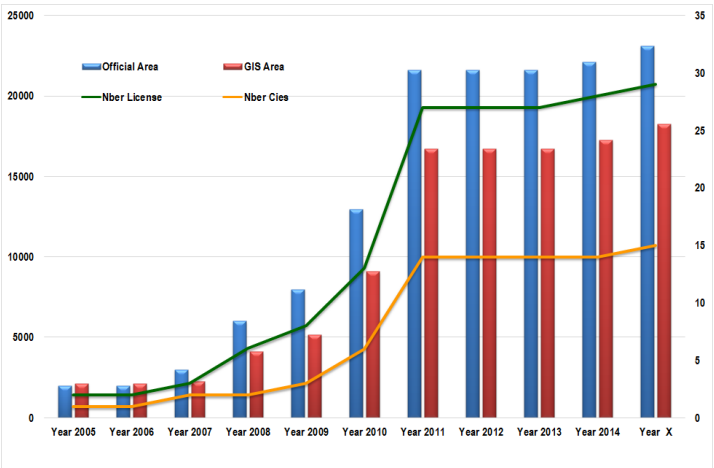
On the basis of the archives of permits and authorizations obtained from the Lom and Djérem Divisional Delegate of Mines, we have built charts (figures 1-2) which show the situation of the mining permits in Eastern Region since 2003 (Figure 2) and in the Lom & Djérem Division since 2005 (Figure 3).

Figure 2. Mining permits granted to the Eastern Region of Cameroon since 2003.



Source: Field surveys 2015 and Tchindjang et al., 2015).

Figure 3. Mining licenses granted to the Lom & Djérem Division since 2005.



(Field surveys 2015 and Tchindjang et al., 2015).

Compared to the rest of the territory, these exploration licenses account for at least 70 to 80% of the Lom & Djérem territory compared with 50-70% of the Eastern Region area (figures 4-5) . Of the 160 licenses granted in the whole country, half are from the Eastern Region and Lom & Djérem has 29 licenses straddling it territory.

Figure 4. Mining Permit of the Lom & Djérem Division.

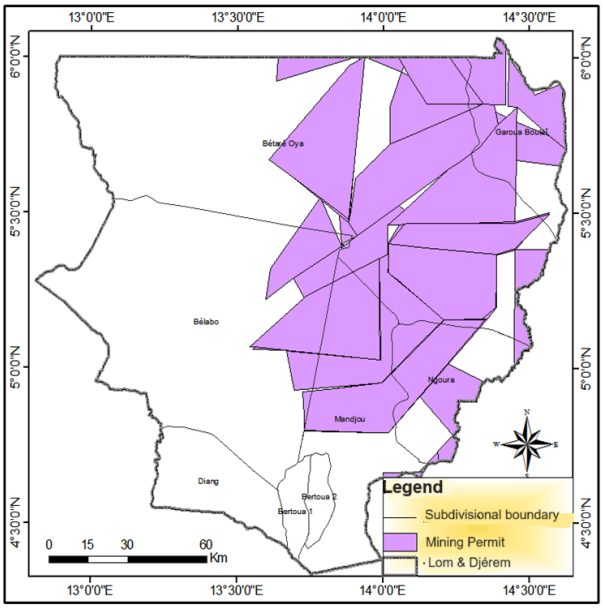
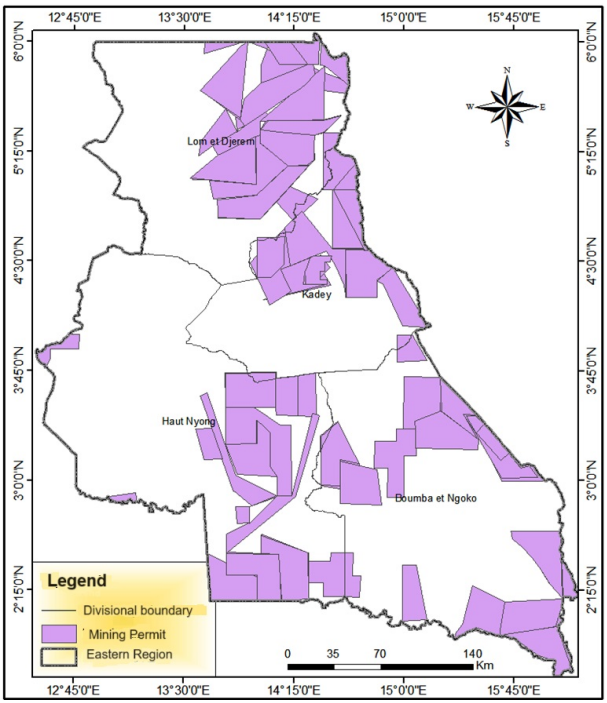


Figure 5. Mining Permit ine the Eastern Region.

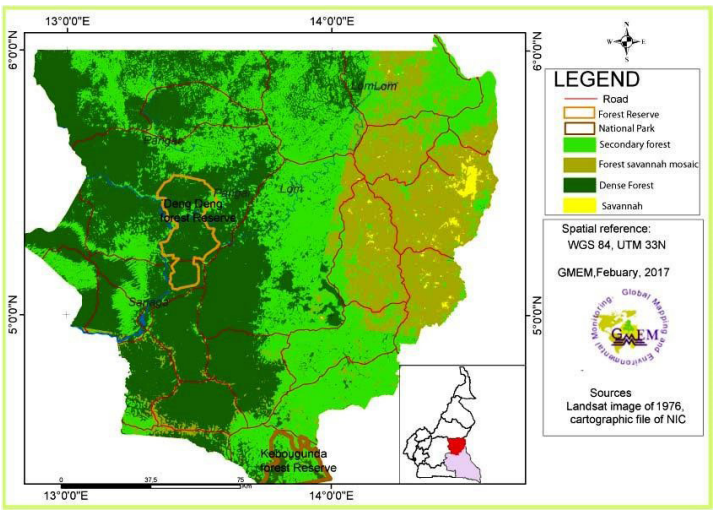


We found that the official licenses granted do not always match with those obtained on GIS. The number of companies holding exploration permits increased from just one in 2003 to more than 40 companies in the Eastern Region (Figure 2) and 15 in Lom & Djérem (Figure 3). Such a result shows the extent of land use in this area once known for its forest resources and which is currently experiencing difficulties in integrating the various activities on its soil; there is the dilemma.

4.2 LAND USE DYNAMIC MAPPING

Land use maps were obtained after processing and classification of Landsat images. Figures 3-7 show these maps and it is curious to observe on filed survey that the exploration licenses become operating permits and it is difficult to distinguish them. In 1976, the forest covered more than 2/3 of this territory (Figure 6).

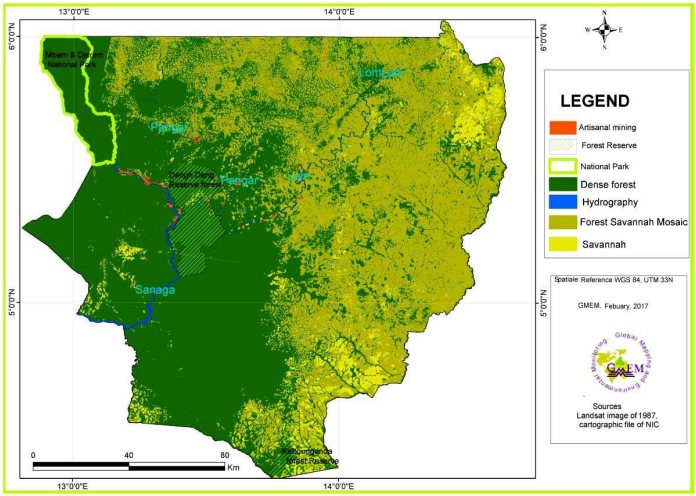
Figure 6. Land use in the Lom & Djérem in 1976 (Landsat MSS).



In 1976, the Lom & Djérem hosted 4 types of vegetation: dense forest, secondary forest, forest-savannah mosaic and savannah. As conservation is concerned, there were 2 protected areas: the Kobungounda Forest Reserve and the Deng-Deng Reserve. The artisanal gold exploitation has not yet begun.

But in 1987, the Lom & Djérem shows a noticeable change with the occurrence of artisanal mining, which proceed by exploring the valleys of rivers, including the Lom and Pangar rivers (Figure 7).

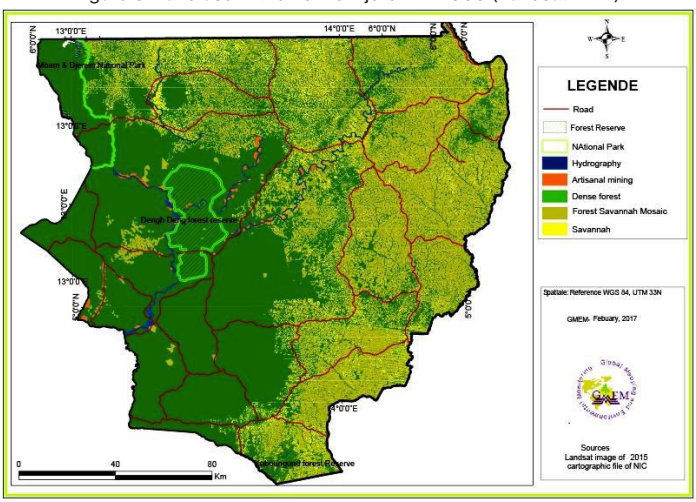
Figure 7. Land use in the Lom & Djérem in 1987 (Landsat TM).



However, the dilemma began at this area with is the forefront of the conservation in Cameroon. What is worrying is the disappearance of secondary forest in favor of the mosaic savannah forest and savannahs. As regards conservation, apart from the two previous reserves, the Mbam and Djérem National Park is added to these two protected areas.

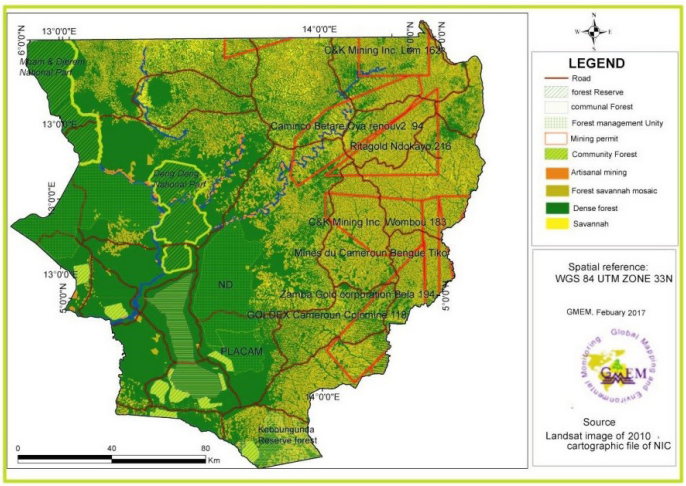
In 2000, the situation has changed dramatically with an explosion of artisanal gold mining along the valleys of the main rivers (Figure 8). There are also some plots within the Sanaga valley at the Southwest of the Map. These incursions of artisanal exploitation can be observed even in the protected areas. In addition, the savannah seems to have retreated in favor of the forest-savannah mosaic. The Kobungounda Forest Reserve also appears to be threatened by the development of the Bertoua town.

Figure 8. Land use in the Lom & Djérem in 2000 (Landsat ETM).



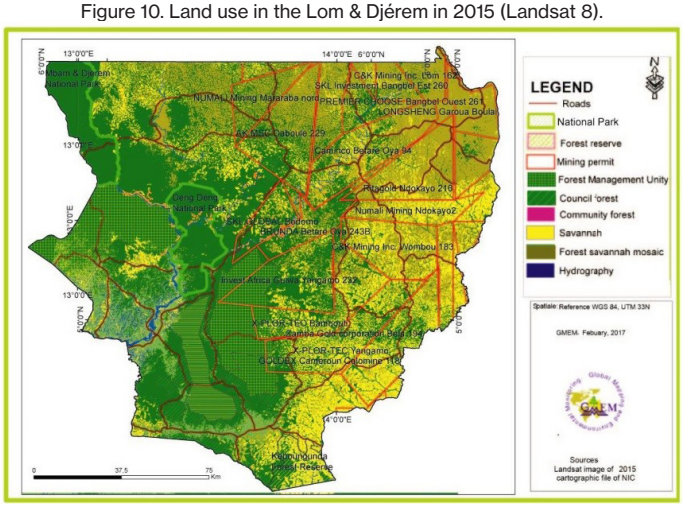
In 2010, the situation has worsen, because new land uses have been set up in Lom & Djérem with council forests, community forests and forest management units (FMUs), as can be seen in figure 9 that shows some licenses granted.

Figure 9. Land use in the Lom & Djérem in 2010 (Landsat 8).



Artisanal gold mining has been coupled with the granting of mining exploration permits and mining licenses since 2005. This includes the licenses of CK Mining, CAMINCO, Goldex Colomine and Zamba Gold. This situation will increase in 2015 and the first overlaps, mines-mines, UFA mines, mines - agriculture, mines - communal forest, mines - community forest, mines - other forms of land use (Figure 10) .

Figure 10. Land use in the Lom & Djérem in 2015 (Landsat 8).



The incursions of artisanal exploitation will get intensifying in the Deng-Deng national park. The savannah areas have increased considerably while the forest is crumbling.

There is therefore an intense deforestation which progresses from the Eastern part of the division towards its western part where the forest still seems relatively conserved. Table 1 summarizes this situation and shows a decline of at least 60% in the forest.

Table 1. Deforestation and mining dynamics in the Lom & Djérem.

Matter	1976-1987 rate	1987 -2000 rate	2000-2010 rate	2010-2015 rate	1976-2015 rate
Dense Forest	-32.09	-40.50	-13.32	12.79	-60.50
Forest - Savannah Mosaic	-16.09	4.90	-29.01	95.35	22.07
Savannah	401.90	381.73	-29.82	105.50	3386.94
Artisanal mining	-	120.28	14.24	18.21	197.48
Mining license	-	-	-	2786.1	2786.15
Community forest	-	-	-	125.77	2333.03
Council forest	-	-	-	420.98	420.98
Protected area	0	0	89.64	0	865.53
Hydrography	38.88	99.86	-2.42	-39.60	63.58
Bare soils and housing	100	50	300	108.33	2400

Source: Authors & Tchindjang et al. 2015.

5 DISCUSSION

The mining industry in Cameroon as well as in the Congo Basin is a dual sector that combines industrial mining operators with artisanal miners. Artisanal miners exploit deposits using rudimentary technologies for gold, diamonds and sapphires processing. Toxic chemicals are used in the artisanal gold mining (especially cyanide). Industrial operators generally use mechanized equipment to access deposits near the surface. The waste coming from these activities is thrown within the rivers water killing biological life.

The Lom & Djérem is the northernmost part of the Eastern Region of Cameroon. It constitutes a hub of biological diversity, which has led to the creation or erection of some protected areas.

The Mbam and Djérem National Park (416512 ha) created in 2000 due to the decommissioning of Pangar-Djérem National Park (177480 ha) because of the Doba-Kribi Pipeline. Only the southern portion of this park appears in the Lom & Djérem territory.

The Deng-Deng National Park created in 2010, replaced the former Deng-Deng Forest Reserve and increased its area to meet the challenges of deforestation and poaching. It is also close to the Mbam and Djérem National Park and forms a coherent network of protected areas that could be linked by an ecological corridor along the Djérem River. It is covered by dense rain forest, characterized by the presence of threatened

primate species, including great apes (gorillas and chims), but also by a diversified avifauna and entomofauna.

The Koboungounda Reserve (54,457ha) in the urban influence area of the Bertoua city is under threat. The council forest with an area of 59,602 ha. FMUs occupy area of 150,310 ha. Areas of hunting interest with a total area of 86,592 ha.

As pointed out by Kund and Megevand (2013), the development of industrial and artisanal mining in the Congo Basin is competing with other land uses, including forestry and conservation. All these protected areas are threatened by the sometimes clandestine and semi-mechanized artisanal mining which takes place there, without forgetting the legal logging and the illegal artisanal logging linked to the avatars of the 'mining. These brought the dilemma. Indeed, totalling protected areas yields an area of 505,669.77ha (19.38 %), compared to 1,823,589.66 ha (69.89 %) of mining permits; Less than three times the mining permits. Even with the addition of community forests, 645 570, 62 (24.74%) were obtained; Hence a strong threat not to be overlooked. Thus, even if mining appears to be an opportunity, the negative impacts are numerous.

Nevertheless, at the end of the exploration, the company does not wait for the exploitation permit to begin, hence the intensification of deforestation. If it waited, it would have been fixed only on the places where the ore is mined to calculate, unfortunately, the practice at this level is unorthodox. As a result, we realize that conservation and permits occupy 90 to 95% of the territory of this division, treating other land use activities: agriculture pastures, buildings etc. a great dilemma and challenge that lead to recurring land use conflicts in this territory.

This paper is the first piece of work to have dealt with field work in an operational and objective manner throughout the Lom & Djérem. Indeed, the works of Nguepjouo and Manyacka (2008), Tieguhong (2009), Nono (2011), Schwartz et al. (2012); Nodem et al. (2012), Relufa and CED (2014) concern the Boumba & Ngoko or Kadey division. In addition, the result from Kund and Megevand (2013) deepens the question of the impacts of mining activities in the Congo Basin. These authors also point out that "much of the discourse on conflict minerals rightly emphasizes human rights concerns, but unfortunately, very little extraction takes place in the most important ecosystems on the planet: the Congo Basin".

The geographical information system, remote sensing and the use of geospatial tools do not exist in the former research. Of course, we have not forgotten to refine the economic (although official statistics do not exist) and ecological aspects. Our work focuses on employment and income (poverty), forest management, biodiversity management and conservation. It is clear that the land-use maps produced by this study

are the first for official statistics in this division, at the very moment when consultations are being held on a master plan for the management and sustainable development of the whole Eastern Region.

5.1 SOME OBSERVED PROBLEMS

In all the African and Latin American countries where mining is taking place there are a host of problems with the onset of poverty issues at mining sites despite positive progress in increasing productivity in the industry. Our research and previous studies highlight contentious issues related to small-scale mining operations and land use conflicts that require urgent attention from regulatory authorities (Akabzaa and Ayamdoo, 2004; Agbesinyale, 2003; Hilson 2002; Songsore et al., 1994). These include: the relationship between small-scale miners and multinational mining enterprises; the land poverty in the mining area; the role of traditional authorities; the lack of adequate institutional support; the limited opportunities for capital; the encroachment on forests and protected areas. It emerges that these issues are deeply rooted in the social and economic circumstances of the small-scale mining sector and can have serious consequences on livelihoods or subsistence as well as mining itself (Kiendrebeogo, 2014).

5.2 LESSONS LEARNED

In terms of lessons learned, the following deserve to be retained.

First of all, mining activity is highly destructive of the biophysical and socio-economic environment. Secondly, extractivism prevails over laws that would benefit from being enforced, revised and strengthened while School wastage and family destructuring are too important to go unnoticed.

Thirdly, the failure of planning, the loss of local development and the accentuation of poverty suggest the curse of wealth and the tragedy of the common good. But, there is also a stubbornness of populations and extractivist societies, and unfortunately, populations are poorly trained and poorly equipped, while administrations are equipped to cope with the extractivist powers.

The triumphant extractivism of Cameroon accomplished with the blessing of the investors easies the fall of the authorities in an unorthodox practices under the label of transparency (non-payment of the ad valorem tax, minting of criminal offenses and other abuses).

6 CONCLUSION

Roughly speaking, mining in Cameroon is more than 80 years old. Its modern form comes from the promulgation of a genuine mining code in 2001 revised in 2010 & 2016. The objective of this research in the Lom and Djérem Division is to study, apart from the proliferation of mining licenses and actors, the dilemma as well as the impact of the extension of mining activities on the degradation of forest cover. Indeed, multi-date and multi-scalar land use change maps computed from the Landsat and Google Earth imagery have helped to determine the real impacts of mines in the process of deforestation. In addition, the mapping of the extension of the artisanal and industrial mines of Cameroon makes it possible to situate the overlaps and conflicts of land use recurring and bringing dilemma between conservation and mining. Consequently, in view of the decline of the forest (32-60% in 40 years), it seems important to go to suitable solutions, some of which are outlined as a result:

There is a need for zoning, better governance and rigorous planning of mining activities through land-use plans that are based on ultra-high resolution (HHR) images and to be included in local development plans (PDL) or council development plans (PDCs).

Mining alternatives must be found through income-generating activities and, at the same time, awareness-raising and training of mining craftsmen and miners.

Considering the valorisation of Protected Areas and the different geotopes through ecotourism and sustainable tourism, it is also possible to reinforce and implement articles 19 and 86 of the mining code on the cost of rehabilitation, without forgetting the inclusion of Payment of ecosystem services in the *ad valorem tax*. The cost of carbon emissions in exploration and mining must also be calculated and integrated.

Traceability between mining permits and other permits (hunting, UFA forest concessions) to defuse overlapping conflicts. It is necessary to mining ministry (MINMIDT) to supervise the closure of the exploitation bore hole and encourage the systematic reforestation of these sinks.

For local populations, the creation of water points, boreholes and sinks for food and water needs of populations is essential. It should be accompanied by the creation of ponds with filters that serve as a system for recycling water from washing areas before they are discharged into rivers. This can serve to reinforce the resilience of the population.

At the end of this research, which focused on the dilemma of mining against forest and conservation and linked to artisanal mines, one has the right to ask oneself whether to continue this mining adventure? This questioning is in line with that of mining Industries, extracted at any price?

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REFERENCES

Akabzaa, T. & Ayamdoo, C. (2004). *Increasing the Contribution of Artisanal Mining and Small-Scale Mining to Poverty Reduction Targets: A study of regulatory and institutional framework for artisanal and small-scale mining in Ghana,* London: Department for International Development.

BUCREP, (2010). *Recensement général de la population et de l'habitat 2005. Rapport de présentation des résultats définitifs ».* Yaoundé, 65p.

Eba'a Atyi, R. Lescuyer, G., Ngouhouo Poufoun, J., Moulendè Fouda, T., (2013). *Étude de l'importance économique et sociale du secteur forestier et faunique au Cameroun*. Rapport Final. CIFOR Bogor 278p.

FAO, (2005). Inventaire forestier national du Cameroun 2003-2004. Rapport final, version préliminaire.

Gartlan, S., (1989). *La conservation des écosystèmes forestiers au Cameroun*. UICN, 186p.

Hilson, G. M., (2002). 'The future of small-scale mining: environmental and socioeconomic perspectives', *Futures*, 34, 863–872.

Kiendrebeogo, A., (2014). *Contribution de l'étude d'impact de l'exploitation artisanale de l'or sur les moyens d'existence des populations riveraines de la forêt classée de Tiogo dans la région du Centre-Ouest du Burkina Faso.* Mémoire de Master Pro. SEN, UYI, Département de Biologie et Physiologie végétales. Yaoundé, 81p.

Kuété, M., (1990) – *Géomorphologie du plateau Sud Camerounais à l'Ouest du 13° E*. Thèse de Doctorat d'Etat, Université de Bordeaux III. 917p.

Kund, K. & Megevand, C., (2013). *Dynamiques de déforestation dans le bassin du Congo Réconcilier la croissance économique et la protection de la forêt* – Document de travail n°4 Exploitation Minière. 69p.

Letouzey, R., (1985). *Notice de la carte phytogéographique du Cameroun au 1/500000. Fascicules N°3, Domaine de la forêt dense semi caducifoliée*. Institut de la carte de la végétation (Toulouse) et IRA (Yaoundé), pp. 63 – 94.

MINEF. (1993). *La politique forestière du Cameroun. Document de politique générale*. Yaoundé, 33p.

Nodem, V., Bamenjo, J.N. & Schwartz, B., (2012). *Gestion des recettes tirées des ressources naturelles au niveau des collectivités locales au Cameroun. Redevances Forestières et Minières à Yokadouma, Est du Cameroun*. RELUFA, 72p.

Nguepjouo, D. & Manyacka, E., (2008). *Exploitation minière artisanale dans la province de l'Est Cameroun: cas du département de la Boumba et Ngoko Etats des lieux: constats, analyses et recommandations.* CED, Yaoundé, 65p.

Nono, C. A., (2011). *Impacts de l'exploitation artisanale de l'or sur l'environnement et le développement socioéconomique à Bétaré Oya / Est Cameroun*. Mémoire de Master Professionnel, Université de Dschang, CRESA FORET BOIS Yaoundé, 119 p.

RELUFA-CED, (2014). *Suivi de contenu local et des obligations fiscales des compagnies minières au Cameroun: Cas du projet du diamant de Cameroon and Korea Mining Incorporation, Mobilong, Est Cameroun*. 45p.

Schwartz, B., Hoyle, D. & Angriffe, S., (2012). *Tendances émergentes dans les conflits liés à l'utilisation des terres au Cameroun. Chevauchements des permis des ressources naturelles et menaces sur les aires protégées et les investissements directs étrangers*. Rapport WWF, CED, RELUFA; 20p.

Songsore, J., Yank son, J. & Trikala, G., (1994). *Mining and the Environment – Towards a Win-Win Strategy: A study of the Tarkwa-Aboso-Nsuta mining complex*, Legon: University of Ghana.

Suchel, J.B., (1988). *Les climats du Cameroun*. Thèse doctorat d'État, Université de St-Étienne, 4 vol. 1188 p.

Takoutsi, R. C., (2009). *Analyse environnementale de l'artisanat dans le Faro Deo. Perspectives pour le développement*. Mémoire de Master II Professionnel, Université de Dschang, CRESA FORET BOIS Yaoundé, 101p.

Tchindjang, M., Mbevo Fendoung, P., Voundi, E; Saha, F. & Njombissié Petcheu, I. C., (2015). *Impact et suivi par télédétection de l'exploitation minière sur le couvert forestier dans la région de l'Est du Cameroun : cas du département du Lom et Djérem (4°30-6°N & 13°-14°30 E). Rapports MINFORCAM 42 & 162 p.*

Tieguhong Chupezi, J., (2009). *Impacts of Artisanal Gold and Diamond Mining on Livelihoods and the Environment in the Sangha Tri-National Park Landscape.* Yaoundé, Cameroun: Centre pour la recherche forestière internationale.

Villegas, L. W., (2012). *Artisanal and Small-scale Mining in Protected Areas and Sensitive Ecosystems: A Global Solutions Study.* www.asm-pace.org. Accessed 25 June 2015.

De Wasseige, C., Flynn, J., Louppe, D., Hiol, Hiol, F. & Mayaux, Ph. (Éds) (2014). *Etat des forêts 2013. Les forêts du bassin du Congo.* COMIFAC. Weyrich. Belgique. 328p.

World Resources Institute-WRI, (2015). *Atlas Forestier Interactif du Cameroun (V3.0). Document de Synthèse*, 64p.

SOBRE O ORGANIZADOR

Luis Fernando González-Beltrán- Doctorado en Psicología. Profesor Asociado de la Facultad de Estudios Superiores Iztacala (FESI) UNAM, Miembro de la Asociación Internacional de Análisis Conductual. (ABAI). de la Sociedad Mexicana de Análisis de la Conducta, del Sistema Mexicano de Investigación en Psicología, y de La Asociación Mexicana de Comportamiento y Salud. Consejero Propietario perteneciente al Consejo Interno de Posgrado para el programa de Psicología 1994-1999. Jefe de Sección Académica de la Carrera de Psicología. ENEPI, UNAM, de 9 de Marzo de 1999 a Febrero 2003. Secretario Académico de la Secretaría General de la Facultad de Psicología 2012. Con 40 años de Docencia en licenciatura en Psicología, en 4 diferentes Planes de estudios, con 18 asignaturas diferentes, y 10 asignaturas diferentes en el Posgrado, en la FESI y la Facultad de Psicología. Cursos en Especialidad en Psicología de la Salud y de Maestría en Psicología de la Salud en CENHIES Pachuca, Hidalgo. Con Tutorías en el Programa Alta Exigencia Académica, PRONABES, Sistema Institucional de Tutorías. Comité Tutoral en el Programa de Maestría en Psicología, Universidad Autónoma del Estado de Morelos. En investigación 28 Artículos en revistas especializadas, Coautor de un libro especializado, 12 Capítulos de Libro especializado, Dictaminador de libros y artículos especializados, evaluador de proyectos del CONACYT, con más de 100 Ponencias en Eventos Especializados Nacionales, y más de 20 en Eventos Internacionales, 13 Conferencia en Eventos Académicos, Organizador de 17 eventos y congresos, con Participación en elaboración de planes de estudio, Responsable de Proyectos de Investigación apoyados por DGAPA de la UNAM y por CONACYT. Evaluador de ponencias en el Congreso Internacional de Innovación Educativa del Tecnológico de Monterrey; Revisor de libros del Comité Editorial FESI, UNAM; del Comité editorial Facultad de Psicología, UNAM y del Cuerpo Editorial Artemis Editora. Revisor de las revistas “Itinerario de las miradas: Serie de divulgación de Avances de Investigación”. FES Acatlán; “Lecturas de Economía”, Universidad de Antioquía, Medellín, Colombia, Revista Latinoamericana de Ciencia Psicológica (PSIENCIA). Buenos Aires, Revista “Advances in Research”; Revista “Current Journal of Applied Science and Technology”; Revista “Asian Journal of Education and Social Studies”; y Revista “Journal of Pharmaceutical Research International”.

https://orcid.org/0000-0002-3492-1145

ÍNDICE REMISSIVO

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