Study Of The Environmental And Social Impact Of The Construction Of A Wood Cluster

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Abstract

The growth of our economy depends mainly on the creation of wealth through the value added. This creation of wealth requires that the Cameroonian economy truly committed to the path of deepening processing various products including timber, which is currently exported immediately after the initial processing. To go further in the transformation, it is necessary to build clusters and other essential tools. However, for the construction of a cluster, it is important to take the relevant environmental provisions.

This study on "Project of construction of a wood cluster in Yaounde: socio-environmental impacts and prospects", responds to this preoccupation. It was designed to assess the environmental and social impacts related to construction of a cluster timber Yaounde.

To do this, we conducted raids at Minkoameyos, a village site for the cluster timber driver. It is located in the Borough of Yaounde VII, Mfoundi Department, Central Region. We were using a questionnaire, conducted a socioeconomic survey of 7 local households directly touch by project and 62 others in the locality. A multi-resource inventory of the site and the consultation of the parties involved have also been necessary.

The site is an area of approximately 11.76 hectares, an area of land leveled to about one hectare which can be seen here and there the remains of the materialization of the project stands and warehouses timber yard on the site originally planned. We also note the presence of a house under construction coordinates (X = 768295 Y = 428266). The multi-resource inventory of the site has counted 639 stems representative 23 species that correspond to a gross volume of 1,549.6 m^3. In addition, we noted the juvenile character of the vegetation and fauna poor (rodents and small mammals).

Keywords: Impacts, environment, wood cluster, measures, Yaounde

1. Introduction

In most developing countries, the forestry sector receives very little funding for protection and, above all, reforestation. Developing countries in general, and Cameroon in particular, are suffering from the major constraint of massive debt and economic stagnation. These countries also have other investments to make in several sectors at the same time, and the forest inevitably suffers from the competition. It should be noted that the timber sector is a major contributor to GDP. It accounts for more than CFAF 400 billion in export earnings and employs more than 40,000 people. It is a sector of strategic importance, but the resources allocated to it are relatively small compared with the needs, especially when it comes to reforestation. The processing policy seems to be weakly oriented towards finished products (MINFOF, 2009).

Since the advent of the financial crisis that affected the timber sector, the public authorities have begun to give more thought to the development of semi-finished and finished products. Most analysts agree that there can be no competitive forestry industry without a domestic market. The development of domestic markets is therefore a strategic issue for African producers. Cameroon, a country whose domestic market is growing rapidly with population growth and which has a surplus of sawn timber production, will have a greater need to develop industries that enable wood to be processed successfully, and will also have an interest in directing the development of industrial infrastructures towards factories that can give the best added value to semi-finished or finished products intended for export (Taylor, 2009).

According to Carret and Clement (1993), who carried out a study on the competitiveness of African timber, the foreseeable consumption of sawn timber in 2025 is estimated at 1.71 million Round Wood Equivalent (RWE) for Cameroon, while its possible exports at the same period are estimated at 2.29 million RWE. Hence the need to put in place structures and a legal framework capable of providing a proper framework for these developments in the Cameroonian timber market.

With this in mind, the Government of Cameroon, in collaboration with the World Bank, has been identifying the Competitiveness of Growth Sectors Project (PCFC) since September 2008.

The PCFC should provide the government with tools and new opportunities for economic development in line with the country's new strategic vision for 2035. This vision classifies the wood industry as one of the priority sectors for competitiveness.

The implementation and operation of activities related to this financing are likely to cause positive and negative socio-environmental impacts that need to be identified, characterized and optimized and/or mitigated, in accordance with the relevant national and international legislation and regulations (Law N°96/12 of 05 August 1996 on the Framework Law on Environmental Management, Decree No. 2005/0577/PM of 23 February 2013 laying down the procedures for carrying out environmental impact assessments, Order No. 0070/MINEP of 08 March 2013 laying down the various categories of operations subject to an EIA and the various conventions that Cameroon has ratified).
Generally speaking, this study aims to assess the environmental and social impacts associated with the construction of a wood cluster in Yaoundé. More specifically, it aims to :
- characterize the site on which the cluster is to be built ;
- assessing the impacts of the activities associated with setting up a wood cluster on the physical, biological and socio-economic environment;
- proposing an environmental and social management plan for the various types of impact.

2. Scope of the study

This section presents the geophysical, biological, human and socio-economic characteristics of the project area. Three localities have been identified for the establishment of the cluster: Minkoameyos (Yaoundé VII district), Koaban (Yaoundé IV district) and Olembé (Yaoundé I district). A study is currently underway to choose the best site for the cluster. For the purposes of our study, we have limited ourselves to the Minkoameyos site.
(Fig 1).

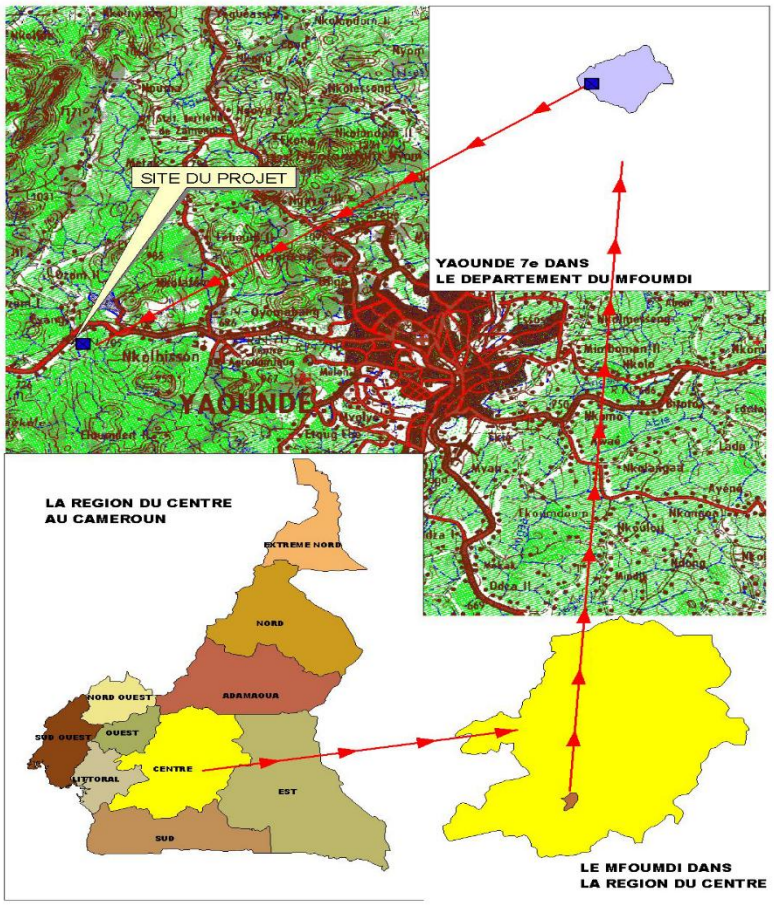

Figure 1 : Location de la zone d'étude.

Methods

The maps were collected and the study area delineated based on limits. Visual interpretation led to false colour composition and assigning the zone of interest leads to training site identification. Maximum likelihood classification was done which gives supervised classification and post classification process. Separability test was also done in conformity to the GPS reading collected from field work and ground verification was done.
Identification of impacts was done using Leopold's grid based on the potential interaction (positive and negative) that could exist between the activities of the project and environmental components. Impact receptors, valorised elements of the environment that could be affected by the construction work.
These valorized elements are grouped into three components:
- physical milieu;
- biological milieu;

- human milieu (economic activities, employment, health and security).

The sources of impacts are the different activities of the project that can affect valorised elements. The descriptions of impacts consist in presenting for each identified impact the cause, manifestation and eventually the effect. Identification of impacts was also done during the excavation of clay material in this zone.

Characterization and evaluation of impacts

Characterization of impacts involves the description of impacts using well defined criteria to evaluate them in a way to determine their magnitude and order of priority in which these impacts could be avoided, mitigated or compensated. To this, the criteria used for characterization of impacts are:

- the nature of impact which could be positive or negative;
- interaction of impacts which could be direct (D) or indirect (ID);
- the extension of impact, linked to spatial dimension such as the surface area affected. The three levels to measure this indicator are: a) regional extension (R), characterize an impact that can touch 100 % of the zone of project site or above; b) local extension; describe an impact that is limited on the site and c) punctual extension; characterise impact localized on a precise point;
- the intensity of impact is relative to the degree of disturbance in the milieu, sensibility, vulnerability and scarcity of the affected components, it could be low, average, or high;
- the occurrence of impact determines the probability in which an impact can be produce, it could be certain or probable;
- the reversibility of an impact indicates whether an impact is reversible (RE) or irreversible(Irr).

The gravity of an impact which is determined by the superposition of these indicators below permits the evaluation of each impact of the project. These three levels are used to describe an impact; major (M), average (Av) and minor (Mi); major impacts are those that cannot be neglected. There is an obligation to provide mitigation and /or compensatory measures, average impacts are noticed thus mitigation measures are provided, and minor impacts are not very important but there is need for compensation. Impacts are classed into significant (Sig) and insignificant (insig). This classification is a result of a strict way of identification and evaluation. Thus, significant impacts are those that have major effect on the environment and for which mitigation measures are to be provided. The following table illustrates parameters for impact characterization.

Table 1. Parameters for impact characterization.

Criteria for characterization	Value of characterization
Nature	Positive
	Negative
Duration	Short term
	Medium term
	Long term
Intensity	High
	Average
	Low
Reversibility	Reversible
	Irreversible
Interaction	Direct
	Indirect
Extension	Regional
	Local
	Punctual
Gravity	Major
	Average
	Minor
Occurrence	Certain
	Probable

The evaluation of each impact was done by crossing three of the above criteria (intensity, extension and duration) using the evaluation grid adopted by Martin Fecteau because of its simplicity (Table 2). The aim of this evaluation is to give absolute importance to an impact; thus, impact evaluation permits the attribution of a relative value to an impact which could be major, average or minor which occur during the exploitation and construction phases.

Table 2. Evaluation matrix of impacts.

Intensity	Extent	Duration	Significance of impact		
			Major	Average	Minor
High	Regional	Permanent	+		
		Temporary		+	
	Local	Permanent	+		
		Temporary		+	
	Punctual	Permanent		+	
		Temporary			+
Average	Regional	Permanent	+		
		Temporary		+	
	Local	Permanent		+	
		Temporary			+
	Punctual	Permanent		+	
		Temporary			+
Low	Regional	Permanent		+	
		Temporary			+
	Local	Permanent		+	
		Temporary			+
	Punctual	Permanent			+
		Temporary			+

The proposed environmental measures regroup actions, corrective dispositive, alternative management modes and alternative measures to correct, mitigate, compensate, eliminate every negative impact or enhance positive impacts. Efficiency, cost, adaptation to the Cameroonian context and feasibility are among the development of these criteria measures.

Indicators and monitoring of auditors/supervisory**.** The indicators and verifiers have been defined. An indicator is a quantitative variable for measuring the disturbance caused by an activity in a location and during a given period. An auditor is a source that provides the information necessary for obtaining objectively verifiable indicators.

Environmental and Social Management Plan

This is a set of specifications that lists all environmental measures and practices that the company responsible for carrying out the work must observe scrupulously. These measures are developed in consultation with stakeholders (public consultation).

Data analysis

In this study, information gathered through interviews, observations, questionnaires and from the maps of 1989 and 2015 was analyzed using spread sheet program such as Microsoft word 2010, Excel 2010, QGIS 2.8.1 and ERDAS to come out with maps, averages, percentages, tables and others. The mapping of the study area is made using QGIS 2.8.1 and ERDAS software. The analysis of the data will be to bring the results on: Identification and description of impacts, characterization and evaluation their importance, propose mitigation measure and finally the elaboration of the environmental and social management plan

3. Results

Caractérisation le site devant abriter le cluster

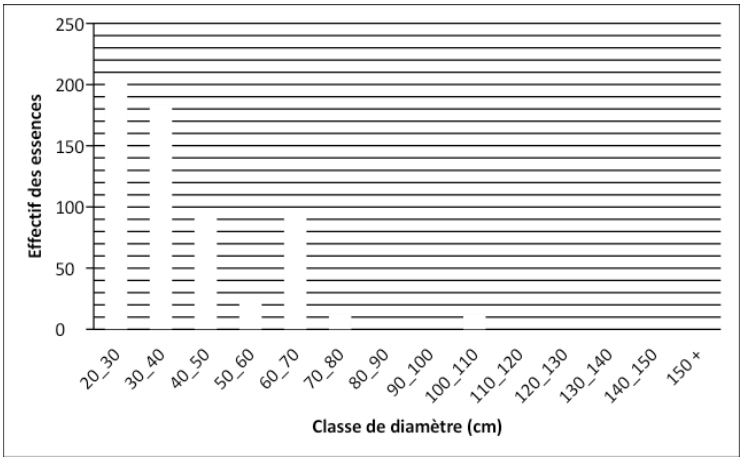

Figure 3 : Répartition des arbres inventoriés par classe de diamètre.

The project is located in the village of Minkoameyos on the old Yaoundé-Douala axis between latitudes 427900 and 428500 north and 760100 and 760600 east longitudes in UTM data.
Covering an area of 11.76 ha, including 1 ha of level land, the site is bounded to the north by a large rock, to the south-east by a ravine leading to a swamp, to the north-east by a cocoa plantation and to the west by the site planned for resettlement under the Yaoundé Urban Community project, as illustrated in figure 2 below. The house closest to the site is still under construction and is located 30 m from the north-western boundary of the site.

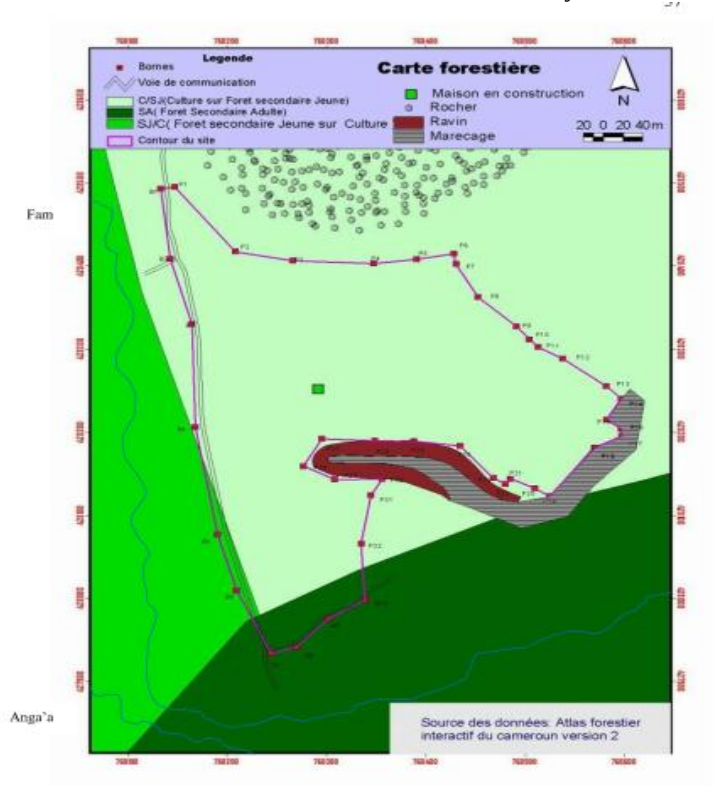

Figure 2.: Cluster site

The area's vegetation is characterized by three strata, including cultivation on young secondary forest (very well represented), mature secondary forest (poorly represented) and young secondary forest on cultivation (almost non-existent). The majority of the trees recorded are between 20 and 50 cm in diameter (79% future trees), reflecting the juvenile nature of the site's vegetation (Fig. 3).

It emerged from consultation meetings with local people and from participant observation that wood processing activities in the LPIA are varied. There are 1st transformation structures (artisanal sawing using mobile saws) (Fig.4) and 2nd and 3rd transformation structures with furniture as the main product. There are 03 joineries, all located in Minkoameyos, most of whose equipment is dilapidated. Most of the wood they use comes from the Leboudi market and artisanal sawing. Furniture is made from badly dried and untreated wood. The waste from the various processes (offcuts, sawdust, shavings, wood powder) is used as firewood by households, which buy it (Fig.4).

Figure 4: Wild sawing on the project site.

Assessment of the environmental impact of the activities associated with setting up a wood cluster

Apart from changes to the landscape, which are positive in nature, all of the 6 other impacts relating to the physical environment are negative. For the biological environment, the 2 impacts identified are negative. Of the 9 likely socio-economic impacts identified, 4 are positive.

Table 3 below summarizes the impacts identified, characterized and assessed using the interrelationship, characterization and assessment matrices.

Tableau 3: Summary of identified and assessed impacts.

Impact designation	N°	Nature	Absolute importance	Importance relative	Significance of residual impact
PHYSICAL ENVIRONMENT					
Air pollution	1	-	Average	Average	Minor
Noise pollution	2	-	Major	Major	Average
Soil degradation	3	-	Minor	Minor	Not significant
Soil contamination	4	-	Minor	Minor	Not significant
Surface water pollution	5	-	Average	Average	Minor
Degradation of groundwater quality	6		Minor	Minor	Minor
Landscape modification	7	+	Average	Average	Average
BIOLOGICAL ENVIRONMENT					
Destruction of vegetation and loss of biodiversity	8	-	Average	Average	Minor
Wildlife disturbance and depletion	9	-	Average	Average	Minor
SOCIO-ECONOMIC ENVIRONMENT					
Job creation	10	+	Major	Major	Major
Increased capacity for innovation and processing quality	11	+	Major	Major	Major
Development of related economic activities and increase in household income and quality of life	12	+	Major	Major	Major
Increase in C.A.Y.VII tax resources	13	+	Major	Average	Average
Risk of deterioration in workers' health	14	-	Average	Average	Average
Risk of an increase in the prevalence and spread of STIs/AIDS and in the number of unwanted pregnancies.	15	-	Major	Average	Average
Various accident risks	16	-	Average	Average	Average
Risk of conflict	17	-	Minor	Minor	Minor
Loss of farmland and crops	18	-	Minor	Average	Minor

Environmental and Social Management Plan

Tableau 4: **Environmental and Social Management Plan.**

N°	Measures	N° Impacts	Objectives of the measures	Implementers	Objectively verifiable indicators	Implementation schedule	Follow-up actors	Cost of measures (FCFA)
1	**Systematic maintenance of equipment, vehicles, machines and dryers**	1, 4, 5, 6	Limit air pollution, reduce soil and water contaminatio n.	-Site manager -workers -PCCB socio-environmental manager	-Technical inspection certificates for vehicles and machinery; -Vehicle and equipment maintenance data sheet -Presence of chimney -Number of training sessions	From the start of construction and during the operational phase of the wood cluster	MINEP	To be included in project costs
2	**Solid and liquid waste management**	1, 4, 5,6	Limiting soil, air, surface and groundwater pollution	-PCCB socio-environmental manager	-presence of procedure manual -presence of the recovery contract -liquid products stored on concrete surfaces	From the outset of ESMP implementation	MINEP	25 million (Capacity building)

N°	Measures	N° Impacts	Objectives of the measures	Implementers	Objectively verifiable indicators	Implementation schedule	Follow-up actors	Cost of measures (FCFA)
					-Number of training sessions			
3	**Erosion control**	3	limit soil degradation	-Site manager + support Environmentalist specialized in reforestation and creation of green spaces	-Presence of cover crops -Grass on embankments	From the outset of ESMP implementation	MINEP	50 million (revegetation)
4	**Vegetation protection**	8	Stopping the destruction of vegetation	Specialist in reforestation and creation of green spaces	-Number of ornamental and shade trees planted -Green spaces created on bare, unbuilt surfaces -Building 30 m from the marsh	From the start of construction, and during the construction phase	**Leader** MINFOF **Partners** MINEP	To be included in the cost of revegetation
5	**Anti-poaching awareness campaign**	9	Protecting wildlife	provider of platform construction	Number of awareness-raising workshops Awareness-raising posters and leaflets	From the outset of ESMP implementation	**Leader MINFOF Partner MINEP**	20 million
6	**Prevention of STIs/AIDS, unwanted pregnancies and preservation of morals**	15	Ensure the prevention of STIs/AIDS, limit the number of unwanted pregnancies and preserve morals in the ZIDP.	Health awareness specialist, in collaboration with Minkoameyos health centers	Awareness-raising posters and leaflets Number of awareness-raising meetings -Number of condom vending machines installed -Available environmental clauses and guidelines	From the outset of ESMP implementation	**Leader MINAS MINSANTE** **Partners MINEP**	30 million
7	**Safety and prevention of occupational accidents and illnesses**	1, 2, 4, 5, 6, 14, 15, 16, 17	Limit accidents and risks of all kinds; reduce the damage they cause	-PCCB socio-environmental manager with support from service providers	-Presence of a barbeque -useful numbers displayed -Number of fire extinguishers in workshops -Number of HSE staff training sessions -Number of PPE distributed -Number of medicine boxes in the workshop -Safety perimeter	From the outset of ESMP implementation	**Leader MINTSS** **Partners MINEP**	To be included in project costs
8	**Helping to improve people's quality of life**	10, 12	Improve the quality of life of local residents	PCCB Human Resources Manager	-Percentage of premises used -New activities created -Number of premises trained -Presence of the foghorn	From the outset of ESMP implementation	**Leader PCCB socio-environmental manager Partners CAY VII Control mission environmentalist**	Included in PCCB operating costs
9	**Conflict prevention**	2, 14, 15, 16, 17, 18	Limit conflicts between "project-populations", "project-staff" and "staff-populations".	PCCB with local communities and service providers	-Registered complaints -Number of premises recruited -Indemnity payment receipts -Minutes of information meetings Existing problem-solving platform	From the outset of ESMP implementation	**Leader PCCB Environmental Manager Partners MINAS MINEP CAY VII Village chief**	1 million
10	**Compensation for households that have lost**	18	Avoiding land conflicts,	-Commission de constat et	Number of non-payment complaints	Before construction begins	**Leader MINDAF MINADER**	Included in the cost of the RAP

N°	Measures	N° Impacts	Objectives of the measures	Implementers	Objectively verifiable indicators	Implementation schedule	Follow-up actors	Cost of measures (FCFA)
	property (crops, houses, land)		repairing damage, complying with legal requirements for involuntary relocation.	d'évaluation (CCE) -PCCB socio-environmental manager	-Indemnity payment receipts		**Partners MINEP**	
11	**Helping to increase the capacity for innovation and quality in wood processing**	11	Promoting innovation capacity and processing quality in the wood industry	PCCB Training Manager with the support of service providers	-Number of new models present -Improved assembly and finishing quality -System for communication and exchange of expertise between players in the effective cluster -Number of awards granted	During the operating phase	**Leader PCCB Production Manager Partners MINSUP MINIMIDT CPB**	10 million

4. Discussion

The present study required for this project is a detailed environmental and social impact assessment. This is so because it does not only involve the execution of the project alone but also involves public consultation in the project. The different results were obtained from the initial state of the environment during the exploitation of material and the identification of potential impacts.

The most important aspect that is linked to environmental degradation in this area is the disorderly exploitation in this zone and the absence of an exploitation plan. The land use pattern in this area has greatly change leading to an increases in the surface of water bodies from 14% to 30% giving a change of 16 % increase in the surface area of water body and in the number and size over the years. The vegetation cover has decreased from 69% to 32%, giving a variation of 37% in the vegetation cover. These results show that the project could have a significant impact on the vegetation cover result obtained by Guta, (2017). To this end, mitigation measures must be followed to avoid the detection of major changes in the study area by 2035.The degradation of this area has led to numerous accidents in this area and at times the zone is flooded by water from the nearby river which can lead to loss of valuable clay material in the near future, loss of exploitation land and even loss of job opportunities.

In addition to the negative impacts identified in the study area, the implementation of this project is also associated with positive impacts, including employment opportunities, increased government funding and the provision of multidisciplinary subjects for scientific research, These results seem to be similar to those obtained by Mbog et al., (2023), who worked on the environmental and social impact study of the quarry for the extraction of raw materials in the locality of Etoa in the arrondissement of Yaoundé 3, in that most development projects are accompanied by positive impacts on the surrounding population, results that seem to be in line with the work of Ngouana Kengne et al., (2014). However, this study does not confirm the findings of (author), according to which landscape degradation is observed after a period of ten (10) years. This can be understood by the fact that the Environmental and Social Impact Assessment is an exercise that is carried out prior to the implementation of a project and provides a preventive overview of the negative impacts that the project may have.

During the exploitation of clay in this area, the negative impacts include the following; air pollution by smoke from heavy duty vehicles, noise and dust particles', water pollution, Pollution of soil, loss of vegetation and crops (loss of biodiversity), Change of natural landscape, Migration of birds and reptiles in this area, Risk of accident, flooding, migration of birds, pollution of surface and underground water ,risk of conflict, risk of proliferation of mosquito parasites, risk of degradation of transportation pathways and poor management of resources. The presence of all the above correspond to the work of Rebel (2014) realized in Lom Pangar. All the negative impacts were evaluated to 76.2 % while the positive impacts were evaluated to 23.8 %.

The Environmental management plan will enable the project stakeholders, in particular MINTP, MINEPDED, MINRESI, MINSANTE and MINFOF, to take into account all the measures necessary for environmental management during the operation and construction phases. This was also mentioned by Mbog Mbog et al., (2023) on the Draft Environmental and Social Impact Study of the Hydroelectric Dam on the Deng Deng National Park, which, due to the sensitivity of the study area, recommends a participatory implementation of management measures to enable the protected area to achieve its management objectives.

The loss of biodiversity in this area can also be compensated through the rehabilitation and restoration of this area. The consequence is the destruction of biodiversity, loss of animal habitat and farm land.

The real impacts are those whose manifestation is already visible while potential impacts are those impacts which are likely to occur over time. Eighteen (18) impacts were identified and evaluated. From this work only five (5)

were positive impacts and of which we had four average positive impacts and one major positive impact. The sixteen (16) other impacts are all negative impacts with eleven major negative impacts**.**

5. Conclusion

The overall objective of our study was to assess the environmental and social impacts associated with the construction of a wood cluster in Yaoundé and to propose measures to address them. It enabled us to describe the current state of the site that is to house the cluster, and to identify, characterize and assess the impacts of setting up a wood cluster on the physical, biological and socio-economic environment.

This study shows that the construction of the pilot wood cluster will be carried out through various operations such as the acquisition of land (expropriation), the recruitment of labour, the deployment of personnel on site, the clearing of the platform (clearing, stump removal, excavation, excavation / backfill), the construction of various service blocks (workshops, drying unit, offices), the installation of machinery (jointer, router, sander, planer, etc..), the installation of the dryer, the operation of the machines and the dryer, the supply of wood to the cluster, the storage of wood and derived products, the supply of wood treatment products to the cluster, the storage of wood treatment products, the supply and storage of hydrocarbons and lubricants, the use of hydrocarbons and lubricants, the drying of wood, the chemical treatment of wood, the handling of wood,

wood machining, the assembly of wood into various products (e.g. furniture), waste management, the training of industry players by wood specialists, and the repair and maintenance of machinery and vehicles. These are the causes of numerous impacts on the components of the receiving environment.

The methodological approach adopted included stakeholder consultations, socio-economic surveys, a multi-resource inventory of the site, direct observations in the field and documentary analysis.

Through the multi-resource inventory, 639 stems representing 23 distinct species were counted. In addition, the juvenile nature of the site's vegetation was noted, as was the paucity of fauna (rodents and small mammals).

The site is currently occupied by 7 customary landowner households who farm there. There is also a house under construction.

The Léopold matrix was used to identify a number of impacts, and the Fecteau grid was used to help with the overall assessment or evaluation of each of these impacts.

After identification, characterization and evaluation, the main potential impacts are of two types:

Negative impacts could include air pollution, noise pollution, deterioration in water quality, loss of farmland and destruction of crops and housing, damage to workers' health, the risk of an increase in the prevalence and spread of STIs/AIDS and the number of unwanted pregnancies, the risk of various accidents and the risk of conflict.

As for the positive impacts, these could include job creation, an increase in the capacity for innovation and the quality of wood processing, the development of related economic activities and improvements to the living environment.

To mitigate or optimise these negative and/or positive impacts, a set of 5 environmental measures (systematic maintenance of equipment, vehicles, machines and dryers; management of solid and liquid waste; erosion control; protection of vegetation; awareness-raising to combat poaching) and 6 social measures (prevention of STIs/AIDS, unwanted pregnancies and preservation of morals; safety and prevention of accidents and occupational illnesses; contribution to improving people's quality of life, conflict prevention; compensation for households that have lost their property (crops, houses, land); contribution to increasing the capacity for innovation and the quality of wood processing) and an ESMP have been proposed.

Data availability

The data used to support the findings of this study are included within the article.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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