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EFFECTS OF BRICK PRODUCTION ON THE WOOD RESOURCES OF THE URBAN COMMUNE OF LABÉ

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ABSTRACT

The Republic of Guinea is not immune to a disruption of its climate because of an anarchic exploitation of its forest resources. This quantitative research is intended to assess the consumption of wood for cooking and its influence on the timber resources of the urban district of Labé. The abusive logging is environmental issues. In this area the environmental degradation is of concern; the drying up of rivers, the scarcity of certain forest species and the disruption of the climate are felt. So, the goal of this study is to determine the annual quantities produced terracotta bricks and wood used in cooking. The methodology used is based on the investigation with the semi-directed interview technique. Fifteen tree species used as cooking wood were identified. The quantification of wood used was made by airspace, we were able to evaluate up to 2927 m³ of wood consumed per year. Eight brick making areas were located; the picking areas (three in number about) are remarkable. These results show that the decrease of forest resources is a reality in the urban commune of Labé. This study is limited to the impact of the dynamics of the abusive wood cut of cooking on the timber resources of the urban district of Labé.

Key words: Wood, Timber, Baked Bricks.

1 INTRODUCTION

The traditional making of clay bricks for firing poses a danger to our environment. Nowadays, pressure on certain tree species greatly reduces their density, and in some areas, they are very rare or even non-existent. The scale and

seriousness of the problems caused by the degradation of natural resources have become significant worldwide. Preserving biodiversity is currently one of the main challenges facing humanity. A booming population, driven by excessive ambitions and hopes of quick money, pushes the idle layer of our communities towards making fired clay bricks. Faced with these living conditions, people have adopted uncontrolled behaviours toward forest resources. Thus, we are witnessing abusive methods of exploiting woody products for firewood production. It should be noted that the provision of wood for firing clay bricks is proving to have an impact on the environment through major changes in the structure, plant composition, and productivity of these vegetation formations. In Europe, forests were increasingly exploited during the pre-industrial era. Besides the iron industry, other activities also heavily relied on forest resources, which seemed endless a few centuries earlier in Wallonia. Glassworks, lime kilns, and brickworks also operated on wood before turning to coal. Each year, deforestation wipes out about 13 million hectares of forests worldwide. It's noted that Bangladesh produces more than 12 billion bricks each year, which represents a value of around 450 million dollars, almost 1% of the country's GDP. Brick making is the main stationary source of local air pollution and greenhouse gas emissions, given the massive and inefficient consumption of coal and biomass in brick kilns. It is noted that in sub-Saharan Africa, one of the causes of deforestation is the supply of fuel. The production of clay bricks is among the activities that consume the woodiest fuel, while on some lands new forest plantations are appearing. But reforestation does not fully offset deforestation; overall, the "net losses" of forests amount to 7 million hectares each year, and Africa is also heavily affected by forest loss, losing about 4 million hectares annually. Nevertheless, the net forest loss rate is slowing down thanks to new plantations and the natural expansion of existing forests. In the DRC, (8) points out that in Beni, the real estate boom pushes residents to make bricks right on their plots and to destroy all vegetation around the city. At the slightest rain, erosion washes away the houses built on these lands. Attracted by profit, the population ignores the authorities' warnings. According to (12), every day, thousands of hectares of forests disappear from the Earth's surface. In fact, about 13 million hectares were cut down annually between 2000 and 2010. On a smaller scale, that's the equivalent of a football field every second. However, this figure, which may seem huge, only considers what can be measured, because the true extent of deforestation is even greater. As for (1), demand is also high, with 83% of the population in sub-Saharan Africa using firewood for cooking. The production of fired clay bricks is widely practiced in Guinea during the dry season along the Niger River and all its tributaries without exception. It has devastating effects and endangers of soil resources, riverbanks due to uncontrolled and disorderly clay extraction pits, as well as the local vegetation, which is used as firewood for the kilns. For a kiln with a capacity of 18,000 bricks, for example, 3 to 4 loads of firewood are needed, depending on the case. At the current stage of knowledge, the question is: How could firewood consumption related to clay brick production affect the forest ecosystem in the urban commune of Labé?

The overall goal of this study is to assess the human pressure caused by wood collection for brick firing on the woody resources of the urban commune of Labé. Our specific objectives were set as:

- Determining the annual quantities of bricks produced in the urban commune of Labé
- Determining the annual quantities of wood used for their firing

2 METHODOLOGY

It should be noted that the types of data collected are the number of operators, their age, the quantity of bricks produced, the number of bricks per kiln, the number of kilns obtained, the types of forest species used as firewood, the quantity of wood per kiln, and the frequency of use of the forest species.

2.1 Determination of Annual Quantities of Bricks Produced and Wood Used

2.1.1 Determination of the Annual Quantities of Bricks Produced by the Kilns.

Through the survey using the semi-structured interview technique, it was possible to determine the quantity of bricks produced annually by conducting a census. We listed all the sites producing clay bricks in the urban area of Labé. Following a reasoned selection, we chose the makers considered to be the largest producers at each site based on the number of bricks produced and the wood used for firing them.

To count at the level of each maker, the quantity of bricks found on-site was noted. Then, the number of bricks found for each surveyed maker was added up to find the total quantity. For this, we used the Following standard mathematical formula:

$$Q_e = \sum Q_i;$$

i going from 1 to n.

Where

$Q_e \rightarrow$ quantity of bricks made by the respondents.

$Q_i \rightarrow$ Quantity of bricks made by each respondent.

To know the total quantity of bricks made by the producers in the urban commune of Labé, we determined the average number of bricks produced by the respondents. Here is the formula:

$$Q_e / n = \bar{X}$$

Where $\bar{X}$ = the average number of bricks produced by the respondents.

Q_e = quantity of bricks produced by the respondents;

N = Number of respondents.

2.1.2 Determination of the annual quantities of firewood used by brick kilns

The determination of the quantities of firewood used by brick kilns was done by measuring.

At this level, it's an 8m³ dump truck transporting the cut wood from the harvesting site to the brick kilns. To determine the volume of wood in this load, we proceeded as follows: According to the method in (11), the unloaded wood must be categorized based on their lengths and diameters.

- L1: < 3 m short wood
- L2: 3–6 m Medium-length wood
- L3 :6 to13.5 m Longwood
- L4:13.5 m and + Very long wood

According to the same author, for wood diameters up to 19 cm inclusive, it only needs to be measured once. In our case, we took a sample load of wood for cubing. We specifically obtained two types for the load based on category: 3-meter wood and 3 to 6-meter wood. For measuring the diameter, we used the decameter tape.

On the other hand, using the single formula for calculating the volume of felled wood adopted by the French standard, we calculated the volume in m³ of our wood load.

It concerns:

$$V = \pi d m^2 L / 4 \text{ [m}^3\text{]} \quad (1)$$

Where V = volume L = length dm = median diameter.

NB: The results from applying this formula are recorded in a table in Annex 2, page 64.

A maintenance guide (see Annex 1) was developed for this purpose and was used for semi-structured interviews.

These interviews allowed us to collect information from brick operators regarding the firewood used for baking earth bricks.

Calculation of annual firewood consumption. Thus, to know the annual volume of firewood, we divided the volume of wood per load by the number of bricks in a kiln. This gives us the amount of wood needed for one earth brick. Volume of wood per kiln = X (2).

Number of bricks per kiln X represents the amount of wood in m³ needed to bake one earth brick. So, multiplying the annual number of bricks by the volume of wood per brick gives us the annual volume of firewood needed.

$$Q_i \times X \quad (3)$$

Where Q_i (represents the total quantity of bricks produced for the entire working population for one year).

b) The cooking wood consumption for the five years is: 5-year production $\times X$ (4)

2.2 Study area

Labé is a city in the Republic of Guinea, located in the north of the country. It is the capital of Middle Guinea. An important road junction, it was founded around 1755 by Alpha Mamadou Cellou, a religious leader. The urban commune of Labé is located about 450 km from Conakry and is bordered by: Ø to the north by the sub-prefecture of Tountouroun; Ø to the south by the sub-prefectures of Noussi and Daralabé; Ø to the east by the sub-prefectures of Kaalan and Sannoun; Ø to the west by the sub-prefectures of Popodara and Garambé. The urban commune of Labé is located 450 km from Conakry, between 11°10 and 11°42 north latitude and 12°01 and 12°36 west longitude. The area of the communal territory is estimated at 212.36 km² with a population of 107,695 inhabitants, which is a density of 507.134 ha/km². The current administrative division, due to political reforms and population growth, includes 28 neighbourhood's, with 12 urban ones, namely Daka 1, Daka 2, Doghora, Dowsaré, Konkola, Kouroula, Mairie / Leysaré, Madina, Mosquée, Pounthioun, Tata 1, and Tata 2, and 16 suburban ones: Bambaya, Companya, Donhol, Donholdayébhé, Fady, Fafabhé, Falobowé, Horésaala, Koulidara, Lombonna, Nadhel, Petewel, Poreko, Saalandouyebhé, Safatou 1, and Safatou 2

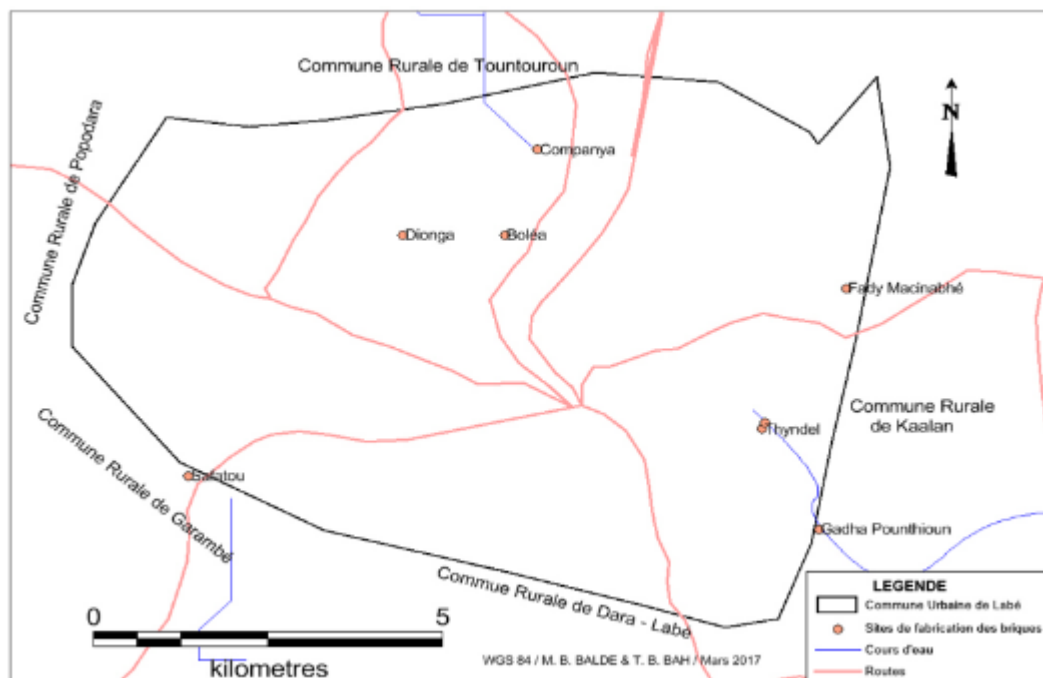


Figure 1: Map of the brick-making sites in the urban community of Labé

3 RESULTS PRESENTATION

3.1 Annual quantities of bricks produced, and wood used for their firing

3.1.1 Annual quantities of bricks produced by the kilns

3.1.1.1 Annual quantities of earth bricks produced by the sample

The survey carried out with a sample of 16 people spread across eight neighbourhoods of the Commune of Labé made it possible to identify the production sites of baked earth bricks during the year 2013.

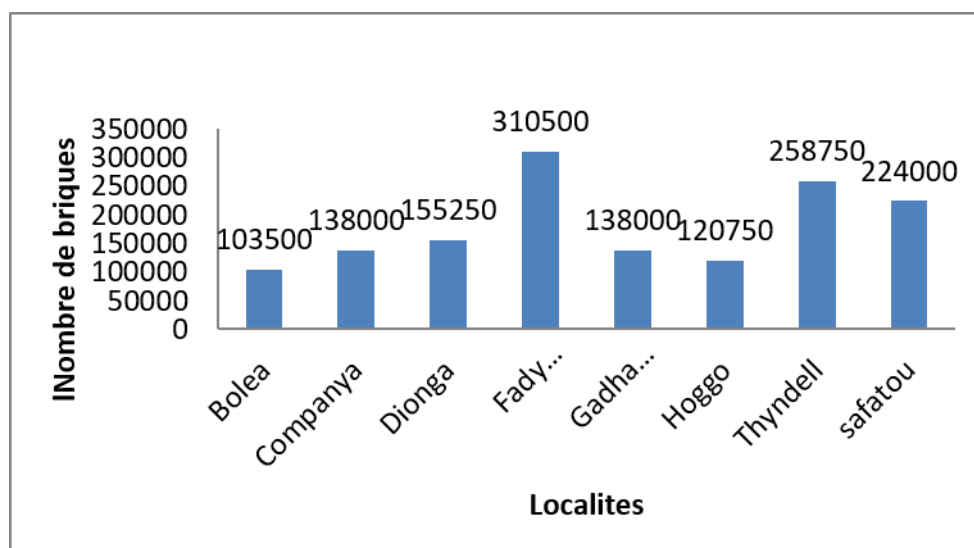


Figure 2: Production sites of baked earth bricks and quantities produced in the C.U. in 2013

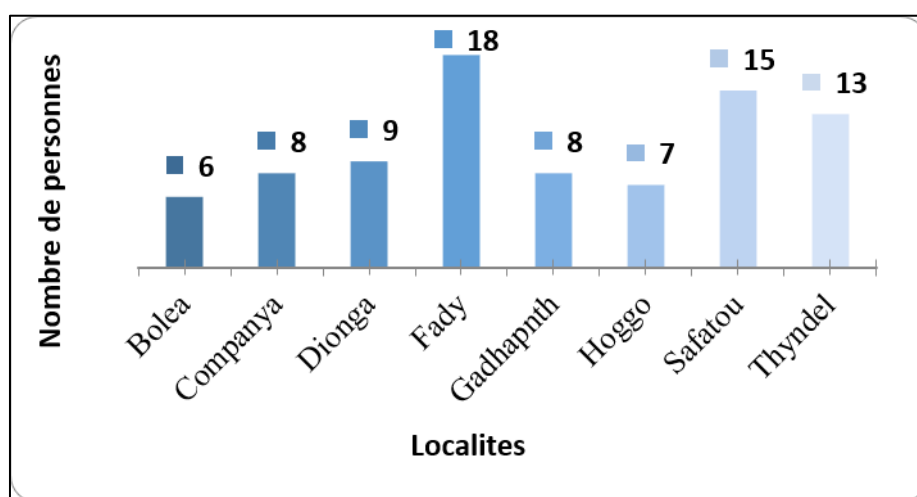


Figure 3: Distribution of the 84 clay brick operators by locality.

3.1.2 The annual amount of firewood used for baking earthen bricks

3.1.2.1 Estimation of the amount of firewood for one brick kiln

For a kiln of 10,000 bricks, that's one load of wood. For the entire load, we counted 338 pieces of wood of various sizes, categorized as follows:

- 82 pieces of 5m with a diameter of 12 cm
- 82 pieces of 4m with a diameter of 14 cm
- 106 pieces of 3m with a diameter of 17 cm
- 68 pieces of 2m with a diameter of 19 cm

$20.749591\text{m}^3 \approx 21\text{ m}^3$ of firewood for 10,000 earthen bricks.

3.1.2.2 Estimation of the amount of firewood for a single earthen brick

So, $21,000\text{ kg} / 10,000 = 2.1\text{ kg}$ of firewood per brick.

3.1.2.3 Estimation of the amount of firewood used for the year 2013

Assuming the average bricks produced per sample is $16,593.75 \times 84 = 1,393,875$ bricks $\times 2.1\text{ kg} = 2,927,137.75\text{ kg}$, or $2,927.13\text{ m}^3$.

b) Assessment of the amount of firewood for the last 5 years

Let the annual production of clay bricks be equal to $1393875 \times 5 = 6969375$ bricks $\times 2.1\text{kg} = 30734943.8 \text{ kg} / 1000 = 30734.9438 \text{ m}$.

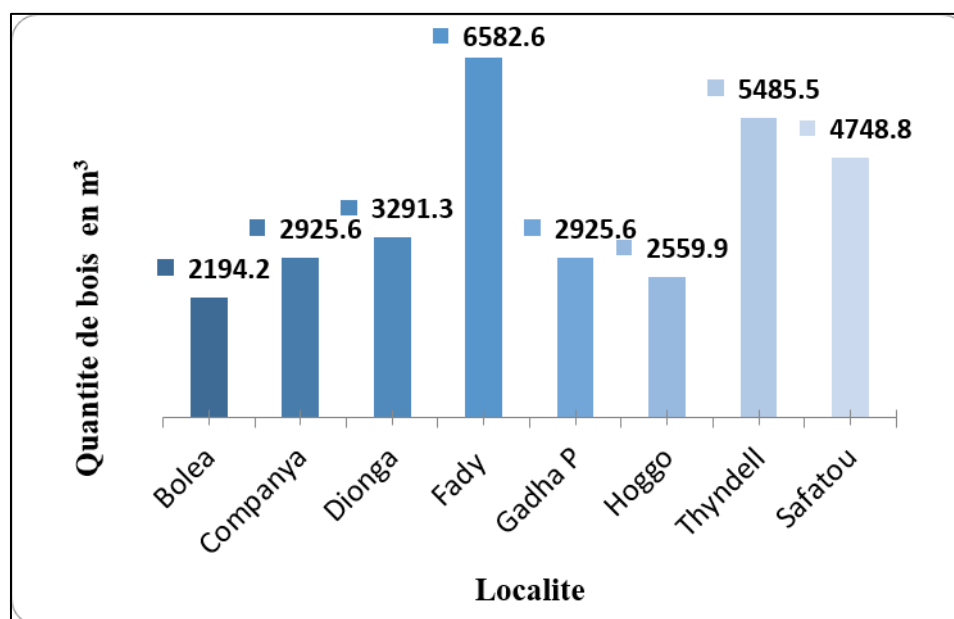


Figure 4: Distribution of the amount of firewood used per locality per year (in m3).

Table 1: Tree Species Used as Firewood

Scientific Names	Common Names	Families
<i>Anacardium occidentale</i> Linn.	Yalaguè	Anacardiaceae
<i>Spondias mombin</i> Linn.	Tyalè	Anacardiaceae
<i>Lannea acida</i> A.Rich.	Tyouko	Anacardiaceae
<i>Khaya senegalensis</i> A.Juss.	Kahi	Méliaceae
<i>Carapa procera</i> D.C.	Gobi	Méliaceae
<i>Afzelia africana</i> Sm.	Linguè	Caesalpiniaceae
<i>Piliostigma thonningii</i> (Schum.) Milne Redhead	Barkehi	Caesalpiniaceae
<i>Erythrophleum africanum</i> Harm	Tely	Caesalpiniaceae
<i>Albizzia adianthifolia</i> W.F.Wight	Bandyalan	Mimosaceae
<i>Albizia gygia</i> J.	Maro-Nai	Mimosaceae
<i>Parkia biglobosa</i> (Jacq.) Benth.	Nètè	Mimosaceae
<i>Parinari excelsa</i> Sabine	Koura	Rosaceae
<i>Mangifera indica</i> Linn.	Mango	Anacardiaceae

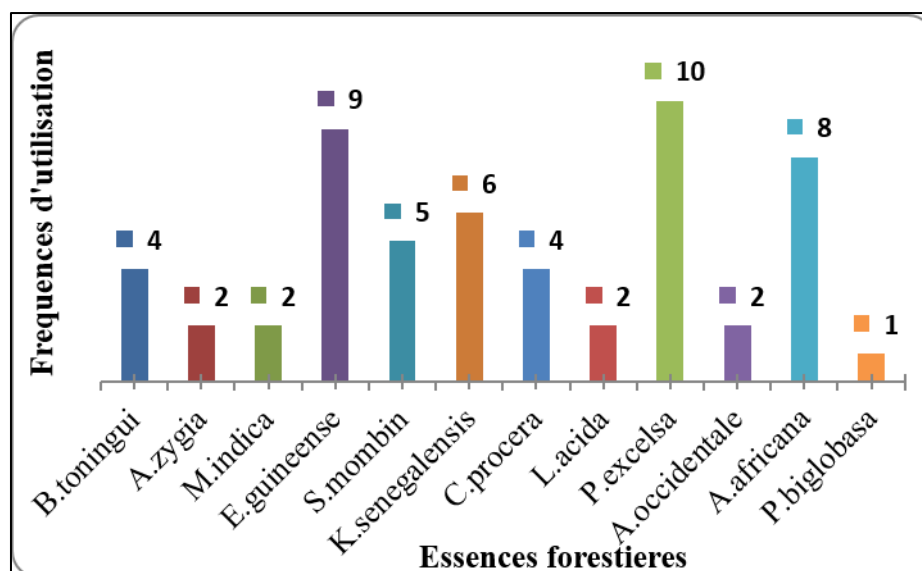


Figure 5: Distribution of the usage frequencies of firewood species for baking bricks in Labe's Urban Community

4 DISCUSSION

4.1 Annual quantities of clay bricks produced, and wood used for firing them

4.1.1 Annual quantity of bricks produced by the kilns

Regarding the distribution of the quantity of bricks made by respondents for the year 2013 (see fig. 4.1), it should be noted that individual productions generally range from a minimum of 10,000 bricks to a maximum of 45,000 bricks, even though the declared intentions far exceed these numbers at the site level. This amounts to a total of more than 250,000 clay bricks per year for the 18 people in the sample. Some farmers also find this new work beneficial; some have even completely abandoned their fields to exploit their plots. They dig sometimes deep holes to extract clay and immediately build kilns behind their homes to fire the bricks. "These bricks never fail to find buyers. "Sometimes the sale happens before they are baked." In the same vein, Makelele Mbafumoy gave up his palm groves for this job, considered more profitable. After six months, he bought a taxi serving the Beni-Butembo route (8). Brickmaking is common in rural areas of Asia, where raw materials are readily available and the demand for building materials keeps growing. Once mixed with water, the clay is molded into bricks, which are then dried and fired in a kiln (6). Also, through Fig. 4.6, which shows the distribution of clay brick workers according to their seniority, it's clear that it's not easy to stick with this kind of work, which is tough and not very rewarding, despite what people might think. Few stay in this kind of job for more than 5 years. They enter it, but soon move on, driven by other ambitions and hopes.

4.1.2 Annual amounts of wood used by brick kilns

The dynamics of energy wood consumption have had a direct impact on the volume of standing timber available in the urban commune of Labé. It should be noted that plant formations with the character of protected forests in the urban commune are spared from abusive logging. Since 1965, Guinea's vegetation cover has decreased by about 140,000 ha (10). It is important to note that all trees can serve as an energy source for brick firing, but considering their energy value, we see a difference in quality in the fired bricks (10). The Koura, *Parinari excelsa*, is both the dominant tree on the region's plateau and an excellent firewood, and its leaves burn without being dried. In our study, the amount of wood needed to fire one brick is 2.100 kg. For the annual production of the urban commune (1,393,875 bricks), this is: 2,927,137.75 kg. it's: 2,927,137.75 kg or 2927.13 m³; For the production over five years (1,393,875 bricks) the amount of wood needed is: 30,734.9438 m³, ≈ 30,735 m³

5 CONCLUSION

The making of clay bricks has been traditionally practiced for decades in the urban community of Labé. It should be noted that this practice has always had a negative impact on biodiversity. Moreover, this practice leads to the degradation of natural resources (water, soil, forest species). The current procedure for making clay bricks contradicts the ecological principles set out by nature conservation. Our observations allowed us to see a number of dangers concerning both biodiversity and natural resources through:

- The gradual decrease of forest species most suitable for providing firewood;
- The selective exploitation of forest species in an abusive and repeated manner, thus promoting the extinction of these line ages (erosion of biodiversity);
- The degradation of soils through the opening of gaping holes. It should be noted that these degraded soils are no longer suitable for use (agriculture, housing, etc.);
- The accumulation of carbon dioxide in nature (greenhouse gas, destruction of carbon sinks);
- Depletion and pollution of surface water resources.

That's why we recommend, among other things: that stakeholders at all levels take responsibility to save this particular and very fragile ecosystem, and above all, to protect endangered forest species.

At a time when international policies on nature conservation are intensifying, the issue of maintaining rich biodiversity deserves more attention than ever.

That's why we recommend, among other things:

- The promotion of technology transfer for making stabilized earth bricks (SEB), which can be stronger, more economical, and more environmentally friendly than traditional fired bricks.
- Continuing activities to protect and secure woody resources undertaken by the government with water, forests and environment officers.
- Raising awareness among rural and urban populations about joint forest management through a formal consultation framework.
- Rehabilitating depleted vegetation through reforestation.
- Fighting poverty in the area by initiating alternative activities.
- Implementing regulatory texts (forest code) and recommendations from scientific seminars and workshops on the environment.
- Returning and sharing the results of this study with the people of the urban commune of Labé in particular, and with the whole of Guinea in general.

The future of Guinea's environment will largely depend on the implementation and enforcement of these recommendations

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

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REFERENCES

- [1] Booth, A. (2013) Firewood drives deforestation in the Congo Basin, while being a potential source of renewable energy. Article
- [2] Dia, A. (1998) Structure and recent socio-economic development of the Labé prefecture (1998) online dia-1998-region-labe-analysis.pdf <doc> 1.011 MB. Consulted on 12 05 2015 17:10
- [3] Global Fund for Agriculture (2005) Deforestation continues at an alarming rate online URL <http://www.fao.org/docrep/MEETING/007/I1562f/>. Consulted on 28 06 2016
- [4] FAO (2005) Zero deforestation and consequences online URL http://www.zero-deforestation.org/p_consequences.htm. Consulted on 28 06 2016 11:38
- [5] FAO (2010) Global Forest Resources Assessment online URL <http://www.uncclearn.org/sites/default/files/inventory/a-i4793e.pdf>. Consulted on 28 06 2016
- [6] GEF-5. (2014) High energy efficiency brick kilns for Bangladesh. Page 16 – 44p.
- [7] Hardy, B., Dufey, J.E. (2012) Estimation of charcoal and forest area needs for pre-industrial Walloon steelmaking (1750-1830). — French Forestry Review, vol. LXIV, no. 4, page 477
- [8] Kokonyange, J. (2012) Beni-the-brick-kilns-are-eating-the-plots. Online URL <http://www.toukimontreal.com>. Accessed on 21 06 2012

- [9] Massenet, J.Y. (2006) Forester's Handbook. Page 9 of Chapter 4
- [10] Maurice, K. (2008) Monograph of the Administrative Region of Labé <http://www.foutapedia.org/documents/BRPD-2008-Monographie-RA-Labe.doc>.
- [11] Massenet (2006). Estimation of Volume. Forestry High School—Château de Mesnières—76270 MESNIÈRES-EN-BRAY. Cited in the following article: Supervised learning method: critical analysis and updating of cubic rate formulas to determine the bark masses of *Prunus africana* (Hook. f.) Kalkman (Rosaceae) in Cameroon
- [12] Mnzava, E. (1981) Rural industries against the savannah. Online URL <http://www.fao.org/docrep/p2070f/p2070f06.htm>. Accessed on 30/06/2014 at 16:20
- [13] Samuel, P. (2012) Deforestation: a problem taken seriously by Africans. URL: <http://perspective.usherbrooke.ca/bilan/servlet/BMAlyse?codeAnalyse=1362> accessed on 12/11/2013