

# Analysis of the Effects of Anthropogenic Activities on the Biodiversity of the Monts Nimba Biosphere Reserve, Republic of Guinea

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## ABSTRACT

This work focuses on the study of the impacts of anthropogenic activities on the forest ecosystem of the Monts Nimba-Préfecture Lola Biosphere Reserve. For data collection, the kobocollect tool was used through a questionnaire developed for this purpose and sent to resource people. The general objective of this study is to assess the impact of anthropogenic activities on the forest ecosystem of the reserve. Thus, Word, Excel and kobocollect software were used for data processing. The results we reached show us that agriculture, practiced by 48% of respondents, hunting 9%, forestry (logging and pharmacopoeia) 25%, livestock breeding 10% and fishing 8% are listed socio-economic activities having harmful consequences on vegetation, fauna, soil and watercourses. *Khaya ivorensis*, *Triplochiton*, *Scloroxylon*, *Terminalia supriba*, *Clorophora excelsa*, *Albizzia zygia*, *Terminalia ivoiriensis*, *Ceiba pentandra* are species used especially in timber exploitation. In addition, *Khaya senegalensis*, *Fagara macrophyla*, *Garcinia cola* and *bombax costantum* are the species used in the pharmacopoeia. Depending on the degree of impact, agriculture and logging are activities with a major effect on biodiversity (flora and soil).

However, livestock farming, fishing and hunting are activities with a medium effect, whereas trade remains the activity with a low effect.

**Keywords :** *Analysis, effect, anthropogenic activities, biodiversity.*

## 1- INTRODUCTION

It is widely recognized that protected areas play a key role in reducing forest loss and degradation (M. RAMBAUD, 2008; Sinsin, B. 1995; Carabias, et al. 2003). The impact of anthropogenic pressures, very felt in developing countries, results in extensive degradation of natural ecosystems, which is not without consequences on the quality of the climate and the life of rural populations who are the more vulnerable (L. L. A. AMOUSSOU et al. 2012; B. Afelu et al. 2016; Rambaud M 2008; R. Mutch et al. 2000). As much as other developing countries, anthropogenic actions on biodiversity still remain a major concern, the Republic of Guinea for example, more particularly in the prefecture of Lola precisely (Sub-prefecture of N'Zoo), the majority of populations, still practices illegal activities in reserved areas (firewood, charcoal, lumber, shifting agriculture, etc.) to satisfy their food and economic needs

(Adorgloh-Hessou et al. 2006). Indeed, to meet their needs, the populations bordering the reserve rely mainly on agriculture, which is traditionally practiced with the use of fires which is a very common ancestral practice in agriculture and land development in tropical zones. (P. MOLOUMOU et al. 2011; G. P. SOUMAORO 2017).

Due to the development of mining activities and the influx of refugees from Liberia, the property was subsequently inscribed on the List of Heritage in Danger (MISSION REPORT, 2017; Report of the joint reactive monitoring mission to the Reserve Integral Nature of Mount Nimba, Guinea/Ivory Coast, 2019; Novacek M.J. et al. global, 2012; Maxime LAMOTTE et al. 2003).

Today, the destruction of habitats is directly linked to anthropogenic transformations of the landscape for agricultural, industrial or urban reasons. By 2030, it is likely that 8.2 billion people will populate the earth, i.e. 32% more than today, however man takes advantage of natural habitats for food, housing, entertainment and this. Which will continually increase demand (IUCN, 2020).

The reserve, thanks to its great diversity of habitats and its numerous niches, is home to more than 317 species of vertebrates, including 107 mammals, and more than 2,500 species of invertebrates (M. Lamotte 2022).

Evergreen forests, often primary forests, occupy the valleys or are found under the plateaus. The savannahs of the lower regions, which lack woody material, occupy lateritic plateaus and form vast open spaces at the foot of the site (Report of the joint reactive monitoring mission to the Mount Nimba Integral Nature Reserve, Guinea/Côte d'Ivoire, 2019; Novacek M.J. et al 2001).

The forest ecosystem of the Nimba Mountains is subject to threats such as: poaching, bush fires, agriculture as well as other increasing anthropogenic pressures due to the rapid increase in the population on the

outskirts of the site, gradually modifying the 'ecology. The buffer zone, which has lost its functionality, exposes the central area to increasing threats. Thus, our study has the general objective of taking stock of the effects of anthropogenic activities for sustainable management of biodiversity in the sub-prefecture of N'Zoo.

## 2- MATERIALS AND METHODS

### 2-1- Materials :

#### *Presentation of the Study Area*

The Nimba Mountains Biosphere Reserve (RBMN) is heir to the Nimba Mountains Strict Nature Reserve (RNIMN) created in 1944. It is the result of numerous scientific research projects and successful approaches by eminent researchers such as Roger Heims, M. Lamotte, R. Schnel, J.C. Leclerck, R. Roy etc. from 1939 to 1944. This integral nature reserve became a Biosphere Reserve in 1980 and its first central area became a UNESCO World Heritage Site in 1981, following the gradual degradation observed in this reserve, the first part of the area Central (world heritage site) was included on the list of heritage in danger in 1992 by the UNESCO World Heritage Committee. The Monts Nimba Biosphere Reserve covers an area of 145,200ha and corresponds to the Guinean part of the Cavally river basin. It includes three (3) categories of protected areas including:

A cluster of three (3) central areas of 21,780 ha strictly protected including:

- The Guinean part of the Nimba Mountains range which constitutes the UNESCO world heritage site of 12,540 ha is our main area of investigation ;
- The Bossou chimpanzee hills of 320 ha and,
- The Déré forest of 8920 ha.

A buffer zone of 35,140 ha where activities are strictly controlled and,

A transition area of 88,280 ha where activities are monitored (P. MOLOUMOU et al. 2011).

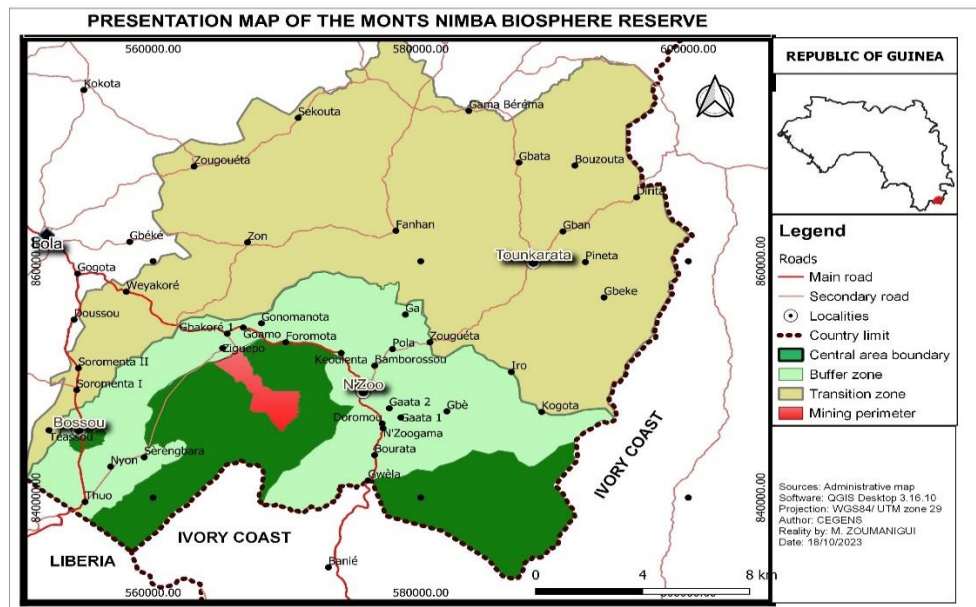


Figure 1- Map of the Nimba Mountains Biosphere Reserve (RBMN) / (SMFG)

## 2.2- Methods

### 2.2.1- Data collection :

Using the kobocollect tool, a questionnaire was developed and sent to resource persons in nine (9) districts of N'Zoo, namely (N'Zoo I; N'Zoo II; Doromou; Bourata; Kéoulenta; Gâah ; Gbakoré and Para). These villages were chosen based on their proximity to central areas; around 30 people were surveyed in the targeted villages. The MARP method (Accelerated Participatory Research Method) was used to identify anthropogenic activities in the study area.

### 2.2.2-Analysis and processing of data

Using Word, Excel and kobocollect software, we analyzed and processed the various data collected in the field, the results

of which are mentioned in the results and interpretation section.

## 3-RESULTS

This step allowed us to manually analyze the data which was collected and processed using Word software. Then, these data were represented in statistical tables.

### 3.1-Different anthropogenic activities listed in the riverside villages

Investigations carried out among local populations and field observations have shown that several anthropogenic activities are carried out in the sub-prefecture of N'Zoo and thus constitute forms of pressure on plant resources in this locality. Its activities are recorded in the table below.

Table 1-List of listed anthropogenic activities and their consequences

Consequences						
N	Activities	Vegetation	Wildlife	Ground	Climate	Watercourse
1	Shifting agriculture					
2	Hunting	Reduction of plant diversity.	Disappearance of wildlife, Habitat disturbance.	Depletion of soil nutrients.	-	-
3	Logging	Reduction of plant cover, Variation of the composition of populations plants.	Habitat destruction, animal migration.	Exposure of the soil to solar rays facilitates erosion.	Rainfall disruption.	Course exhibition of water in the rays Drying up Siltng

4	Pharmacopoeia (levy)	Reduction of plant cover.	Habitat destruction.	Soil degradation.	Rainfall disruption.	Drying up of watercourses.
5	Fishing	Destruction of aquatic flora.	Destruction of aquatic fauna.	Destruction of hydromorphic soil.	-	Drying up of watercourses, Reduction of flow, Deorbiting of beds depletion in aquatic fauna Disruption of aquatic environment.
6	Breeding	Destruction of plant cover.	-	Soil erosion.	-	Water erosion.

It appears from this table that the influence of anthropogenic actions is different from one activity to another depending on the areas above.

✓ **Agriculture**

During our surveys, we found that agriculture is the major concern of the local populations. It is practiced by 48% of respondents. Rice constitutes the main food of the local population, it is cultivated on the hillsides and lowlands. It is practiced in a traditional (extensive) way on slash and burn using farming techniques that do not respect the environment. The populations, for reasons of poverty, adopt itinerant agriculture characterized by the systematic felling of trees on new plots. In addition, they cultivate plantations (cocoa, coffee, small cola, etc.) for the marketing of products. No soil amendment is carried out; this causes soil erosion.

✓ **Fishing**

It is the activity least practiced by the populations (8% of respondents) due to its rudimentary means. The main rivers in which this fishing is practiced are: the Goué, the Déré and the Cavally. It is practiced during the dry season. Carp; catfish; shrimp ; crab remains the most caught fish. The use of inappropriate fishing gear does not promote the sustainable exploitation of water bodies, but reduces the quantity and quality of the fish population.

✓ **Breeding**

It is extensive with small numbers intended mainly for religious ceremonies. The species raised are cattle (SIAKATA), goats and poultry. Cattle were raised in most villages but theft forced the breeders to give up. However, this activity is practiced by 10% of respondents.

✓ **Hunting**

It is practiced by 9% of respondents throughout the year by local populations in the forest and applies to all categories of animal species (sex, age, nature, etc.). It constitutes the only and most accessible way for the population to meet their animal protein needs. The rifle, traps and hunting dogs remain the main means used.

✓ **Logging**

Investigations carried out among local populations have shown that several species are exploited in biodiversity for firewood, carbonization, lumber, medicines and others. Thus, various reasons motivate farmers to exploit plant resources to ensure self-sufficiency. According to survey data, species are exploited according to their utility. Around 15% of respondents exploit the woods. The most exploited species are listed in the table below.

**Table 2- Some species used in timber exploitation.**

N°	Scientific names	Family	Names		Used		
			Konon	Commercial	Carbonization	Firewood	Lumber
1	Khaya ivorensis	Meliaceae	Kpitiri	Mahogany		+	+
2	Triplochiton scleroxylon	Sterculiaceae	Zokolo	Samba			+
3	Terminalia superba	Combretaceae	Wlèan	Framiré			+
4	Clorophora excelsa	Moraceae	Guéli	Iroko	+		+
5	Albizzia zygia	Mimosaceae	Kpanga		+	+	
6	Terminalia ivorensis	Combrétaceae	Bhè	Fraké			+
7	Ceiba pentandra	Bombacaceae	Bharan	Frommager		+	

Analysis of this table shows us that almost all species of wood are used as lumber and appreciated because of their resistance to natural weather.

It is an activity practiced by local populations 10% for medicinal purposes, we meet at least two (2) traditional healers per village. The species frequently used for medicinal purposes and the diseases treated are recorded in the following table.

✓ **Pharmacopoeia**

**Table 3- Some species used in the pharmacopoeia**

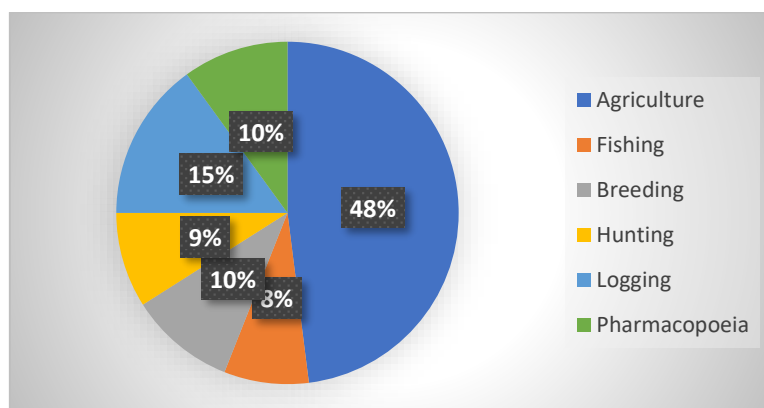
N°	Scientific names	Family	Names		Organs used			Diseases treated
			Konon	Commercial	Leaves	Roots	Barks	
1	Khaya senegalensis	Meliaceae				+	+	Stomach aches
2	Fagara macrophyla	Rutaceae	Kenguènin				+	Sexual weakness; stomach aches
3	Enaceae polycraba						+	Malaria
4	Garcinia cola	Guttiféracée	Toukoulé	Petit cola			+	Sexual weakness
5	Bombax costantum	Bombacacée	Baranh Méré	Baobab		+	+	Yellow fever and dysentery

**Legend :**

+ Organs used

It appears from this table that the organs (bark, leaf and root) of these species which

enter into the pharmacopoeia are the essential parts of the plant; their extraction leads to the disruption of the growth or destruction of these species. See figure 2.



**Figure 2- Execution rate of anthropogenic activities**

### 3.2-Evaluation of the overall intensity of activities on natural resources

After an alarming observation of the current state of natural resources which are severely

degraded by anthropogenic activities, we considered it necessary to make a perfect assessment of the quality and importance of the induced effects.

**Table 4- Classification of anthropogenic activities by degree of impact on biodiversity**

N°	Activities	Elements of biodiversity affected				
		Flora	Watercourse	Wildlife	Climate	Ground
1	Agriculture	+++	++	++	++	+++
2	Logging	+++	-	+	++	+++
3	fishing	-	++	+	-	-
4	Breeding	++	-	++	+	++
5	Hunting	-	-	++	-	-
6	Trade	+	+	+	-	-

**Legend :**

- +++ Major effects
- ++ Average effects
- + Weak effects
- No effects

It appears from this table that flora, fauna, watercourses and soil are the elements of

biodiversity most threatened to different degrees by anthropogenic activities.

### 3.3- Solutions

The table below gives proposed solutions to the most threatening anthropogenic activities.

**Table 5- Solution approaches**

N°	Activities	Proposed solutions	Responsible actors
1	Shifting agriculture	Sufficiently raise awareness among the population ; Develop the lowlands; Popularize new farming techniques ; Practice firewalls.	State and populations
2	Hunting,	Apply the wildlife code ; Encourage breeding.	
3	fishing	Create fish ponds.	
4	Logging	Apply the forest code ; Create community forests; build health posts; Control and organize the timber sectors; respect harvest periods.	

The analysis of this table shows us that several solutions have been proposed for each of these activities, all that remains is the application by the authority and the local populations for sustainable management of natural resources in the locality.

### 4- CONCLUSION

At the end of our research work we reached the following results:

- ✓ Agriculture, practiced by 48% of respondents, hunting 9%, logging (logging and pharmacopoeia) 25%, livestock breeding 10% and fishing 8% are listed socio-economic activities

- having harmful consequences on vegetation, fauna, soil and watercourses;
- ✓ Khaya ivorensis, Triplochiton, Scloroxylon, Terminalia supriba, Clorophora excelsa, Albizzia zygia, Terminalia ivoiriensis, Ceiba pentandra are species used especially in forestry;
- ✓ In addition, Khaya senegalensis, Fagara macrophyla, Garcinia cola and bombax costantum are the species used in the pharmacopoeia;
- ✓ Depending on the degree of impact, agriculture and logging are activities with a major effect on biodiversity (flora and soil). However, livestock farming, fishing and hunting are activities with a

medium effect, whereas trade remains the activity with a low effect.

The elements of the forest ecosystem of the Nimba Mountains Biosphere Reserve each suffer the impact of each anthropogenic activity directly or indirectly and to different degrees.

As approaches to solutions, we proposed the following:

- ✓ Raise widespread awareness among the local population about the consequences of bush fires through the means of communication (radios and community meetings);
- ✓ Strengthen the training capacity of forestry agents in the field;
- ✓ Reforestation of degraded areas ;
- ✓ Develop the rice and market gardening lowlands for the deployment of local populations for more profitable irrigated agriculture ;
- ✓ Encourage the creation of community forests;
- ✓ Directly involve local populations in the sustainable management of biodiversity as well as in the implementation of development projects based on traditional knowledge.

#### **Declaration by Authors**

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