

Diversity of mammalian fauna in the Matiamba and Kobo Classified Forests, in central and northern Côte d'Ivoire

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Abstract

This work was carried out as part of the Forest Investment Project (PIF), initiated by the Forest Development Company (SODEFOR). The aim was to make an inventory of the Mammalian fauna of the classified forests of Matiamba and Kobo. This study, carried out in April 2024, through linear transects and reconnaissance walks, noted that these forest fragments abound in the whole, 17 species of mammals grouped into 5 orders and 8 families. The order Arthiodactyl and the Rodent were specifically the most observed with 59.42% and 23.66% respectively. The Bushbuck (*Tragelaphus scriptus*) was the most abundant species (28.99%) in these forests. All identified species are classified as Least Concern (LC) except for the Yellow-backed Duiker (*Cephalophus silvicultor*), the Black Dorsal-banded Duiker (*Cephalophus dorsalis*) and the African Buffalo (*Syncerus caffer*) which are Near Threatened (NT). In the CITES Appendices, the Yellow-backed Duiker, the Black-dorsal Duiker, the Rufous-sided Duiker (*Cephalophus rufilatus*), Maxwell's Duiker (*Philantomba maxwellii*), African Buffalo and Green Monkey (*Chlorocebus sabaeus*), are listed in Appendix II (IIA). The other mammalian species are listed in Appendix III (AIII). In view of these conservation statuses, these classified forests deserve special attention for their sustainable management.

Keywords: Species richness; Abundance; Mammalian fauna; Classified forests; Bandama Valley District

1. Introduction

Like African forests, Ivorian forest cover is subject to strong anthropogenic pressures [1, 2]. The area of the Ivorian forest, which covered more than 16 million hectares of dense forest in 1960, fell to less than three million hectares in the 2000s [3, 4]. Between 1977 and 1987, Côte d'Ivoire lost 42% of its forest [3]. Globally, this is one of the highest rates of loss of tropical forest systems recorded in the world [5]. Factors that threaten the Ivorian forest ecosystem include forest clearing for agriculture, logging, urbanization, and bush fires [6]. This phenomenon of forest destruction and degradation is increasingly affecting protected areas and classified forests. According to a study carried out by the BNETD [7], the country's 231 classified forests have lost more than 70% of their forest cover in the space of half a century. To reverse the current trend in forest cover, Côte d'Ivoire has been engaged in a forest governance reform for several years, strongly supported by the FLEGT and REDD+ VPA processes. It has set itself the goal of restoring its forest cover and reaching 20% forest cover by 2045 [7]. To achieve this objective, it must strengthen the protection of residual forest areas and sustainably manage its classified forests. The sustainable management of these classified forests necessarily requires reliable and up-to-date information on the state of natural resources. It is in this context that the

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Forest Development Company (SODEFOR), in charge of the management of classified forests through the Forest Investment Project (PIF), has undertaken an inventory of the mammalian fauna of the classified forests of Matiamba and Kobo. The general objective of this study is to determine the conservation value of the mammalian fauna of the classified forests of Matiamba and Kobo, in order to implement a good sustainable management strategy. More specifically, it is a question of determining the species of mammals found in these forest fragments and evaluating their contribution to their conservation.

2. Material and methods

2.1. Study environment

The study was carried out in the classified forests of Matiamba and Kobo, located in the Bandama Valley District. This area is characterized by vegetation composed of islands of dense mesophilic humid forests and dry forests, in a dominant savannah [8, 9, 10]. It is irrigated by the Bandama and N'Zi rivers. The climate is said to be in transition between the Guinean zone in the south and the Sudanese zone in the north, with two seasons, including a rainy season and a dry season [11, 9]. The average annual rainfall recorded varies between 1000 mm and 2500 mm and annual temperatures that oscillate around 39°C [12, 13]. The forests of Matiamba and Kobo have been designated as classified forests since 27 March 1939. The Matiamba forest is located in the Department of Sakassou, straddling the sub-prefectures of Toumodi-Sakassou and Ando-Kékrénou with an area of about 6000 hectares and that of Kobo, in the Department of Katiola near the locality of Ouréguékaha with an area of 11600 hectares (Figure 1).

2.2. Methods

The study was carried out in April 2024. Pedestrian surveys were conducted in the classified forests of Matiamba and Kobo. For the inventory of mammalian species, the combination of transects [14] and reconnaissance walk or Recce [15] was used to cover our study area in order to fill the inadequacies of the linear transect method [16]. The inventories were carried out during the day from 6 a.m. to 5 p.m. This period corresponds to times of great activity of animals with diurnal habits [17]. In addition, visibility at this time of day is optimal for observations of mammalian fauna indices [18]. During this study, 10 linear transects, including 4 for the Matiamba classified forest and 6 for the Kobo forest ranging in length from 2 to 14 km, were prospected and separated from each other by 2.5 km.

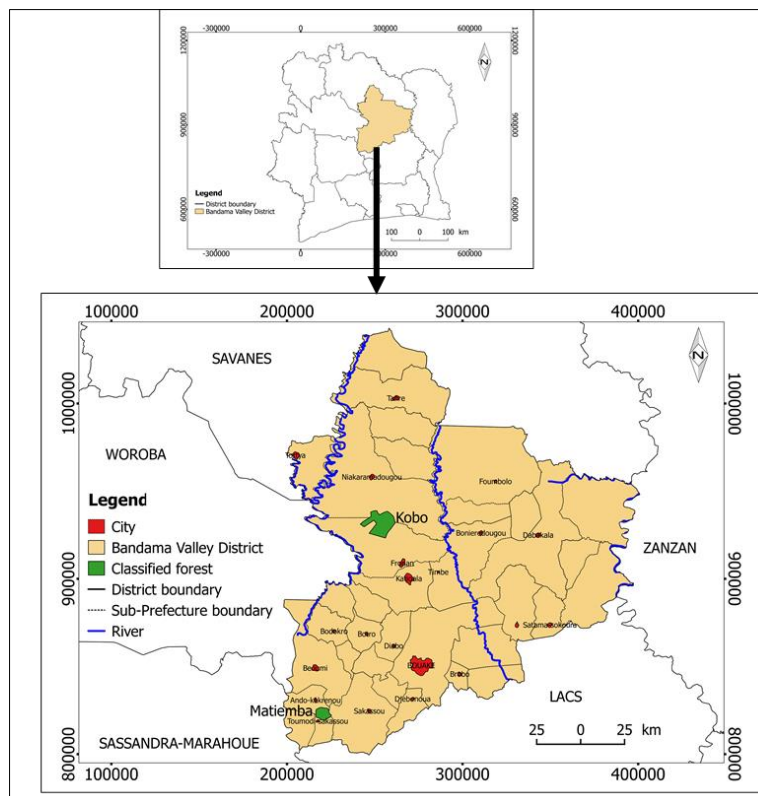


Figure 1 Presentation of the study area

2.3. Data analysis

The identification of the species was done according to our own knowledge of the local fauna and with reference to Kingdon's [19] African Mammal Guide. We calculated the frequency of encounter of the indices according to the classified forests. To determine conservation status, we used the IUCN Red List [20] of threatened species, taking into account the different classification categories. To compare the diversity of mammals in the two classified forests, the Shannon diversity index was calculated. In addition, the Pielou fairness index was calculated to assess the distribution of species within the stand of each forest. All tests are significant at $p < 0.05$. The IUCN Red List [20] was consulted to assess the conservation status of the species inventoried.

3. Results

3.1. Species richness in classified forests

3.1.1. Matiemba Classified Forest

Pedestrian surveys carried out in the classified forest of Matiemba have made it possible to note the presence of several mammalian species through 177 presence indices composed of 157 indirect observations (Ra = 88.70 %) and 20 direct observations (Ra = 11.30 %) (Figure 2). The most abundant indices were the impressions with (N = 123 and Ra = 69.49 %) (Table 1). These indices (direct and indirect) belong to 17 species of mammals divided into 10 families and 5 orders, namely the Artiodactyls, Primates, Rodents, Carnivores and Lagomorphs. The order Artiodactyls was the most represented with eight (8) species. It is followed by the order of Rodents which has five (5) species. Then comes the order of Carnivores comprising two (2) species. Finally, the orders Primates and Lagomorphs are represented by a single animal species. At the specific level, the Bushbuck was the most observed species (N = 59 and Ra = 33.33 %) (Table 2).

Table 1 Relative abundance of evidence of presence in Matiemba classified forest

Type of indices		Number of clues (N)	Relative abundance Ra (%)
Direct observations (DO)	Views	20	11.30
Indirect Observations (IO)	Droppings	8	5.08
	Fingerprints	123	69.49
	Food scraps	19	10.73
	Terriers	6	3.40
TOTAL		177	100

Table 2 Species richness of the mammalian fauna of the Matiemba classified forest

Order	Family	Common name	Scientific name	N	Ra (%)
Artiodactyls	Bovidae	African buffalo	<i>Syncerus caffer</i>	17	9.60
		Buffon's waterbuck	<i>Kobus kob</i>	6	3.40
		Bush buck	<i>Tragelaphus scriptus</i>	59	33.33
		Yellow-backed Duiker	<i>Cephalophus silvicultor</i>	3	1.70
		Duiker with black dorsal band	<i>Cephalophus dorsalis</i>	8	4.52
		Red-sided Duiker	<i>Cephalophus rufilatus</i>	2	1.13
	Maxwell's Duiker	<i>Philantomba maxwellii</i>	19	10.73	
	Suidae	Bushpig	<i>Potamochoerus porcus</i>	4	2.26
Primates	Cercopithecidae	Green Monkey (Callitriche)	<i>Chlorocebus sabaeus</i>	5	2.82
Rodents	Hystricidae	African Atheruure	<i>Atherurus africanus</i>	8	4.52

	Thryonomyidae	Cane rat	<i>Tryonomys swinderianus</i>	12	6.78
	Nesomyidae	Gambian rat	<i>Cricetomys gambianus</i>	4	2.26
	Sciuridae	Palm rat	<i>Xerus erythropus</i>	7	3.96
		Stanger's Squirrel	<i>Protoxerus stangeri</i>	4	2.26
Carnivores	Viverridae	African civet	<i>Civettictis civetta</i>	5	2.82
	Herpestidae	Brown mongoose	<i>Crossarchus obscurus</i>	10	5.65
Lagomorphs	Leporidae	Cape hare	<i>Lepus capensis</i>	4	2.26
TOTAL				177	100

N : Number of clues; Ra: Relative abundance

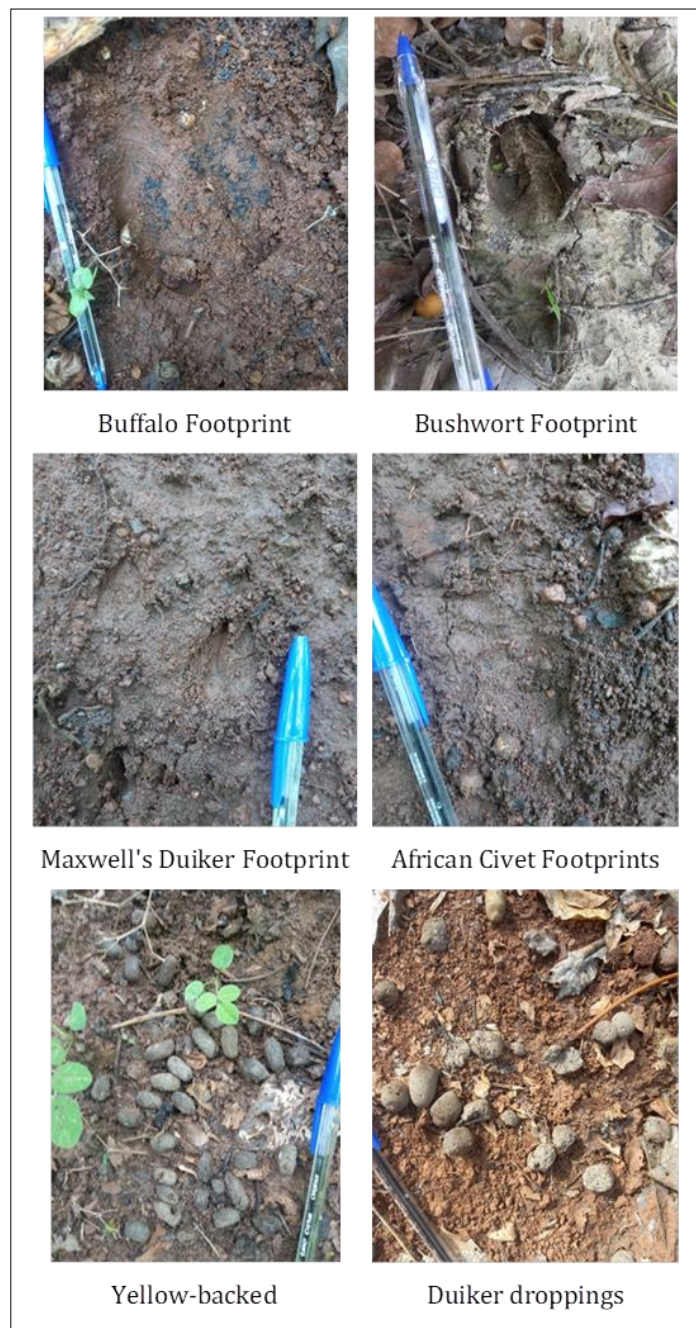


Figure 2 Some signs of presence collected in the Matiamba classified forest

3.1.2. Kobo Classified Forest

During sampling in the Kobo classified forest, 69 indices of mammalian presence consisting of 57 indirect observations (Ar=82.60%) and 12 direct observations (Ar=17.40%) were collected (Figure 3; Table 3). These indices correspond to 12 mammalian species grouped into eight (8) families and four (4) orders. This is the order of Artiodactyls, the most represented with five (5) species. It is followed by the order of Rodents with four (4) species. Then come the orders of Carnivores and Lagomorphs which are represented respectively by two (2) species and one species. In this classified forest, the most abundant species was also the Bushbuck (N=17 and Ar=24.64%) (Table 4).

Table 3 Relative abundance of evidence of occurrence collected in Kobo FC

Type of indices		Number of clues (N)	Relative abundance Ra (%)
Direct observations (DO)	Vues	12	17.40
Indirect Observations (IO)	Droppings	30	43.48
	Fingerprints	12	17.40
	Food scraps	7	10.14
	Terriers	7	10.14
	Bath Mud	1	1.44
TOTAL		69	100

Table 4 Species richness of the mammalian fauna of the Kobo classified forest

Ordre	Famille	Nom commun	Nom scientifique	N	Ar (%)
Artiodactyls	Bovidae	Bush buck	<i>Tragelaphus scriptus</i>	17	24.64
		Duiker with black dorsal band	<i>Cephalophus dorsalis</i>	3	4.34
		Red-sided Duiker	<i>Cephalophus rufilatus</i>	1	1.45
		Maxwell's Duiker	<i>Philantomba maxwellii</i>	2	2.90
	Suidae	Bushpig	<i>Potamochoerus porcus</i>	13	18.84
Rodents	Thryonomyidae	Cane rat	<i>Trynomys swinderianus</i>	5	7.25
	Nesomyidae	Gambian rat	<i>Cricetomys gambianus</i>	2	2.90
	Sciuridae	Palm rat	<i>Xerus rutilus</i>	8	11.59
		Stanger's Squirrel	<i>Protoxerus stangeri</i>	4	5.80
Carnivores	Viverridae	African civet	<i>Civettictis civetta</i>	1	1.45
	Herpestidae	Brown mongoose	<i>Crossarchus obscurus</i>	1	1.45
Lagomorphs	Leporidae	Cape hare	<i>Lepus capensis</i>	12	17.39
TOTAL				69	100

N : Number of clues; Ra: Relative abundance



Figure 3 Some signs of presence observed in Kobo classified forest

3.2. Diversity of mammalian fauna in classified forests

A total of 246 signs of presence corresponding to 17 species of mammals were recorded in the two classified forests. The average species richness in the forests visited is 14.5. The Matiamba Classified Forest has a higher richness (17 species) than that of the Kobo Classified Forest (12 species), although this difference is not statistically significant (p -value = 0.417). Taking into account the abundance of individuals, the calculated indices show trends similar to those of species richness. The average value of the Shannon index is 0.84. This diversity index is relatively high and roughly equal in the classified forests of Matiamba (0.83) and Kobo (0.86) according to the P -value (0.912). As for the average Pielou equitability index (0.84), it reveals that the species are almost uniformly distributed within the stands of these forests. Although the value of the fairness index differs from the Matiamba Classified Forest (0.83) from the Kobo Classified Forest (0.86), there is no significant difference (P -value = 0.991) (Table 5).

Table 5 Values of different indices and species richness of classified forests

Type	Shannon's index	Equitability	Wealth
Matiemba's FC	2.35	0.83	17
Kobo's FC	2.14	0.86	12
Average	2.24	0.84	14.5
	P-value = 0.912	P-value = 0.991	P-value = 0.417

3.3. Conservation status of mammalian fauna in classified forests

3.3.1. Matiemba Classified Forest

According to the International Union for Conservation of Nature (IUCN) Red List [20], the Yellow-backed Duiker (*Cephalophus silvicultor*), the Black-dorsal Duiker (*Cephalophus dorsalis*) and the African Buffalo (*Syncerus caffer*) have a Near Threatened (NT) status. At the level of the CITES Appendices, the African buffalo (*Syncerus caffer*), the Yellow-backed duiker (*Cephalophus silvicultor*), the black-dorsal duiker (*Cephalophus dorsalis*), the Maxwell's duiker (*Philantomba maxwellii*) and the Green monkey (*Chlorocebus sabaeus*) are classified in Appendix II (AII). All other mammal species are listed in Appendix III (AIII) of CITES (Table 6).

3.3.2. Kobo Classified Forest

Table 6 Conservation status of mammalian fauna in classified forests

Ordre	Famille	Nom commun	Nom scientifique	CS	NS
Artiodactyls	Bovidae	African buffalo	<i>Syncerus caffer</i>	NT	AII
		Buffon's waterbuck	<i>Kobus kob</i>	LC	AIII
		Bush buck	<i>Tragelaphus scriptus</i>	LC	AIII
		Yellow-backed Duiker	<i>Cephalophus silvicultor</i>	NT	AII
		Duiker with black dorsal band	<i>Cephalophus dorsalis</i>	NT	AII
		Red-sided Duiker	<i>Cephalophus rufilatus</i>	LC	AII
	Maxwell's Duiker	<i>Philantomba maxwellii</i>	LC	AII	
	Suidae	Bushpig	<i>Potamochoerus porcus</i>	LC	AIII
Primates	Cercopithecidae	Green Monkey (Callitriche)	<i>Chlorocebus sabaeus</i>	LC	AII
Rodents	Hystricidae	African Atheruure	<i>Atherurus africanus</i>	LC	AIII
	Thryonomyidae	Cane rat	<i>Trynomys swinderianus</i>	LC	AIII
	Nesomyidae	Gambian rat	<i>Cricetomys gambianus</i>	LC	AIII
	Sciuridae	Palm rat	<i>Xerus erythropus</i>	LC	AIII
		Stanger's Squirrel	<i>Protoxerus stangeri</i>	LC	AIII
Carnivores	Viverridae	African civet	<i>Civettictis civetta</i>	LC	AIII
	Herpestidae	Brown mongoose	<i>Crossarchus obscurus</i>	LC	AIII
Lagomorphs	Leporidae	Cape hare	<i>Lepus capensis</i>	LC	AIII

CS : IUCN Red List Conservation Status; NS : National Protection Status (CITES); LC : Least Concern; NT : Almost threatened; AII : Partially protected species; AIII : Hunting authorized within the limits authorized by law

All mammal species identified in the Kobo Classified Forest are of Least Concern (LC) according to the IUCN Conservation Status [20]. Except for the Black dorsal Duiker (*Cephalophus dorsalis*) which has a quasi-threatened status (NT). In the CITES Appendices, in addition to the Black-dorsal Duiker (*Cephalophus dorsalis*), the Maxwell's Duiker

(*Philantomba maxwellii*) and the Red-sided Duiker (*Cephalophus rufilatus*) which are listed in Appendix II (AII), the other mammal species are listed in Appendix III (AIII) (Table 6).

4. Discussion

The present study revealed that the classified forests of Matiamba and Kobo are home to 17 species of mammals grouped into 5 orders and 8 families. This species richness is due to the geographical position of these 2 classified forests. Indeed, these forests belong to the transition zone between the southern forest and the savannah of central Côte d'Ivoire, giving them a variety of habitats [11]. They therefore benefit from the presence of many animal species in general and mammals in particular [21]. In addition, the number of mammal orders is comparatively lower than that (9 Mammals) of the Haut Bandama Fauna and Flora Reserve [5], located in the same geographical area as these classified forests. This difference could be justified by the fact that these 2 entities (Classified Forests and Protected Areas) do not enjoy the same protection status [22, 6]. However, the mammal orders identified during this work are representative of most of those encountered in the Haut Bandama Fauna and Flora Reserve [5].

In these 2 classified forests, the order Arthiodactyl and that of the Rodents are the most abundant in terms of species. This could be explained by the fact that the distribution of the animal species constituting these two orders is generally conditioned by various environmental parameters. Indeed, food availability, the diversity of natural habitats and vegetation cover are all environmental variables that influence the diversity and abundance of these mammal species [23, 24]. In addition to these variables, reproduction is one of the biological factors in the distribution of these species. Most of the previous studies carried out on mammals [21, 16] shows that the species richness and abundance of these animal species is a function of habitat types. Other studies on mammals [21,25, 16] obtained similar results. The choice of these habitats by these mammal species depends on their ecological requirements and the characteristics of their habitats [26, 27].

Evidence of the presence of mammalian fauna showed that the population of Bushbuck (*Tragelaphus scriptus*) was the most abundant compared to the other mammal species in these classified forests. Several previous studies have observed similar abundances of this species in different types of natural habitats [28, 16, 25]. The abundance of this species could be justified by its very varied diet and its good adaptation to several types of habitats, even the most disturbed [29, 30].

According to the criteria of the International Union for Conservation of Nature [20] Red List, the yellow-Backed Duiker (*Cephalophus silvicultor*), the Black-dorsal Duiker (*Cephalophus dorsalis*) and the African buffalo (*Syncerus caffer*) inventoried during this study, are near threatened (NT). With reference to the CITES Appendices, the African buffalo (*Syncerus caffer*), the Yellow-backed Duiker (*Cephalophus silvicultor*), the Black-dorsal Duiker (*Cephalophus dorsalis*), the Maxwell's Duiker (*Philantomba maxwellii*) and the Green monkey (*Chlorocebus sabaues*) are listed in Appendix II (IIA). These species can be considered as flagship species to mobilize funds for the conservation of these forest fragments. Conservation actions in favour of these forest relics could contribute to saving many animal species with a special status [6, 31, 25].

5. Conclusion

It appears from this study that the classified forests of Matiamba and Kobo are home to 17 species of mammals grouped into 5 orders and 8 families. In these 2 forest fragments, the order Arthiodactyl and that of Rodents are specifically the most abundant with 59.42% and 23.66% of the total indices respectively. Of all the mammalian species inventoried, the Bushbuck (*Tragelaphus scriptus*) is the most abundant species (28.99%) in these forests. All the species identified in these 2 classified forests are classified as species of least concern (LC) except for the Yellow-backed Duiker (*Cephalophus silvicultor*), the Black Dorsal Duiker (*Cephalophus dorsalis*) and the African Buffalo (*Syncerus caffer*) which are Near Threatened (NT) according to the IUCN conservation status. For the CITES Appendices, the African buffalo (*Syncerus caffer*), the Yellow-backed Duiker (*Cephalophus silvicultor*), the Black-dorsal Duiker (*Cephalophus dorsalis*), the Maxwell's Duiker (*Philantomba maxwellii*) and the Green monkey (*Chlorocebus sabaues*) are listed in Appendix II (AII), while all other mammalian species are listed in Appendix III (AIII). These species of mammals with a special status show how much these forests contribute to the preservation of fauna. It is therefore necessary that special attention be paid by national managers to these forest areas to ensure their effective protection.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There is no conflict of interest.

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