



(RESEARCH ARTICLE)



## Conservation value of the Wadrékro village forest in the Department of Oumé, Central-Western Côte d'Ivoire

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### Abstract

Village forest fragments play a crucial role in wildlife conservation. However, limited information is available on their mammalian diversity. To address this gap, this study was conducted in the Wadrékro Village forest, located in the Oumé department, to identify the mammalian fauna inhabiting the area. The survey involved cataloging mammal species through linear transects and reconnaissance walks (recce). Pedestrian surveys recorded 14 mammal species, grouped into 9 families and 3 orders: Artiodactyla, Rodentia, and Carnivora. These orders are representative of the major mammal groups found in better-preserved areas of the country. Specifically, *Tragelaphus scriptus* and *Thryonomys swinderianus* were the most frequently observed species. According to the IUCN Red List, all recorded mammal species are classified as Least Concern (LC), except for *Hippopotamus amphibius*, which is categorized as Vulnerable (VU). Rural forest patches can therefore contribute to wildlife conservation, particularly for mammalian species.

**Keywords:** Mammalian Diversity; Village forests; Conservation Status; Habitat diversity; Ivory Coast

### 1. Introduction

Tropical forests are considered the world's largest reservoir of terrestrial biological diversity, both in terms of species and ecosystems. They harbor a vast majority of the planet's animal species [1, 2]. According to Lauginie (2007) [3], West Africa boasts exceptional wildlife diversity due to the variability of its ecoregions. In Côte d'Ivoire, efforts have been made to establish a network of protected areas, which includes 18 protected areas and 231 classified forests, aimed at conserving the country's biodiversity [4, 5]. This network hosts the majority of the biological diversity, including 90% of the mammal species known in the West African region [3, 6].

In addition to these protected areas, which constitute the permanent domain of the state, there are rural or Village forests that lack any legal protection status. Nevertheless, these forests often harbor significant biological diversity [7–9]. However, they face numerous anthropogenic pressures, including shifting agriculture, hunting, and illegal gold mining, which threaten their physical boundaries and species richness [10–12]. To better understand the dynamics of habitat loss due to human activities in rural forests, several studies have been conducted in Côte d'Ivoire's Village forests to highlight their conservation status [9, 13, 14]

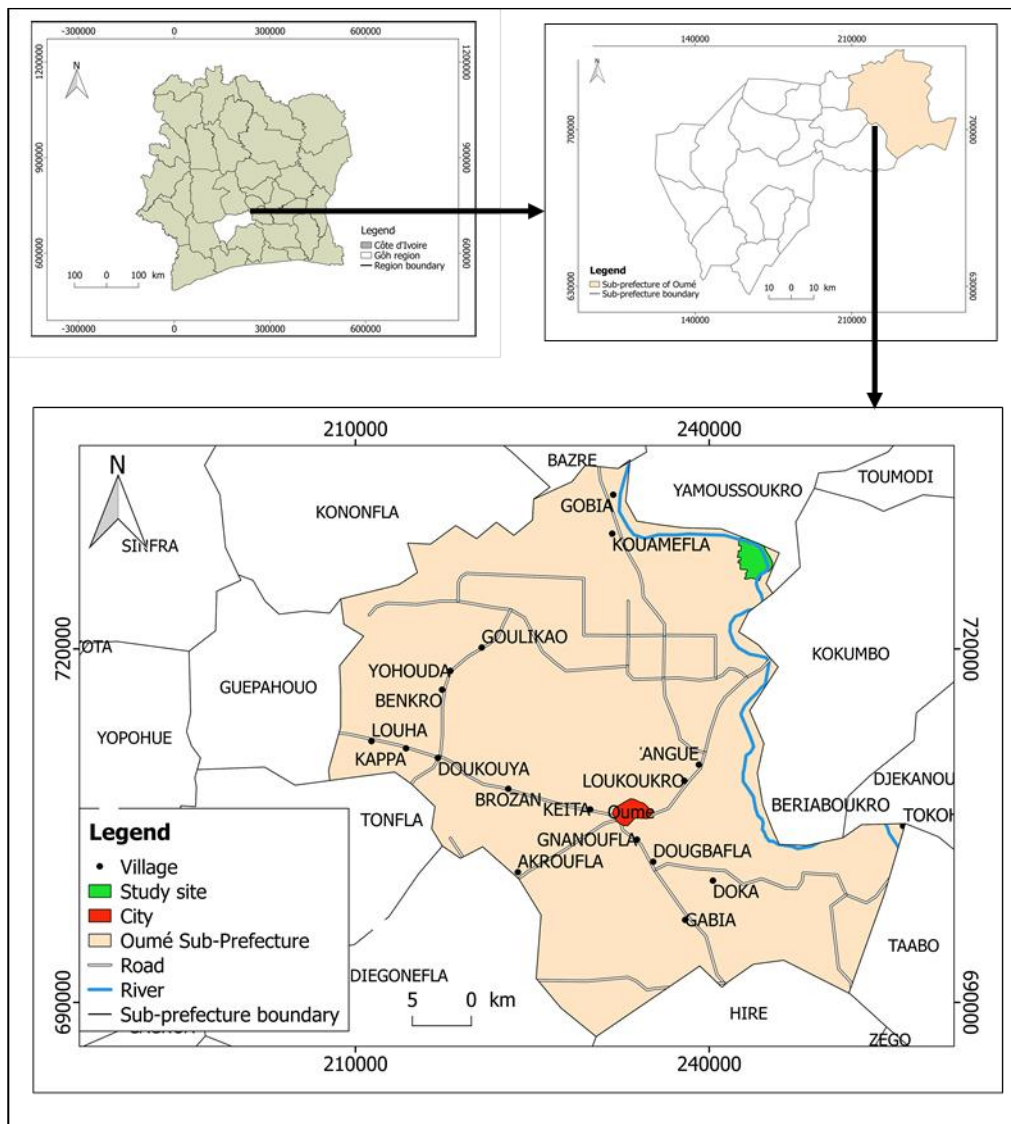
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In the Oumé department, few studies have focused on the mammalian fauna of rural forests. Therefore, it is essential to obtain data on the status of the mammal species in the Village forests of this department to provide information for ecological studies and future conservation strategies. This study, conducted in the Wadrékro Village forest in the Oumé department, aims to determine the diversity of mammalian fauna in this rural forest.

## 2. Material and methods

### 2.1. Study Area

The study area is located in the Oumé department, a town in the Central-Western region of Côte d'Ivoire (5°30' West longitude and 6°30' North latitude), more precisely in the locality of Wadrékro (Figure 1). It is influenced by a sub-equatorial climate, characterized by two rainy seasons from March to June and from September to October, and two dry seasons from November to February and from July to August [15], with an average annual temperature of 32°C and an average annual rainfall of 1200 mm. The area is irrigated by the Bandama River and its main tributary, the Téné [16]. The Oumé department belongs to the mesophilic sector of the Guinean domain, with semi-deciduous vegetation [17]. According to Aubréville (1958) [18], it is a dense forest dominated by *Celtys spp.* and *Triplochiton scleroxylon*.



**Figure 1** Location of the Study Site

## 2.2. Mammal Survey

The mammal survey was conducted in October 2024. Pedestrian surveys were carried out in the Wadrékro Village forest using a combination of two effective and complementary methods: linear transects (Buckland et al., 1993) and reconnaissance walks or recce [19] to cover our study area and collect all relevant information [20]. During this study, five (5) linear transects, each 2 km long and spaced 500 m apart, running from north to south of the forest, were surveyed. The team adopted a slow and steady pace, walking at a speed of 0.5 to 1 km/h, to collect signs of mammalian presence. The surveys were conducted during the day, from 6 a.m. to 5 p.m., a time that corresponds to peak activity for diurnal animals [21]. Additionally, visibility during this time of day is optimal for observing mammalian signs [22].

## 2.3. Data Analysis

The sampled mammal species were identified based on our knowledge of wildlife and confirmed by referencing Kingdon's *Guide to African Mammals* (2013). Encounter frequencies were calculated as the ratio of specific encounters to the total number of encounters for all species observed in the Village forest [23]. To compare mammal diversity across different habitat types in this forest, the Shannon diversity index was calculated. Additionally, Pielou's evenness index was used to assess species distribution within the forest community. All tests were considered significant at  $p < 0.05$ . Data analysis was performed using PAST software, version 4.04 [24]. The IUCN Red List (2024) [25] and the CITES Appendices were consulted to evaluate the conservation status of the inventoried species

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## 3. Results

### 3.1. Mammal Species Richness

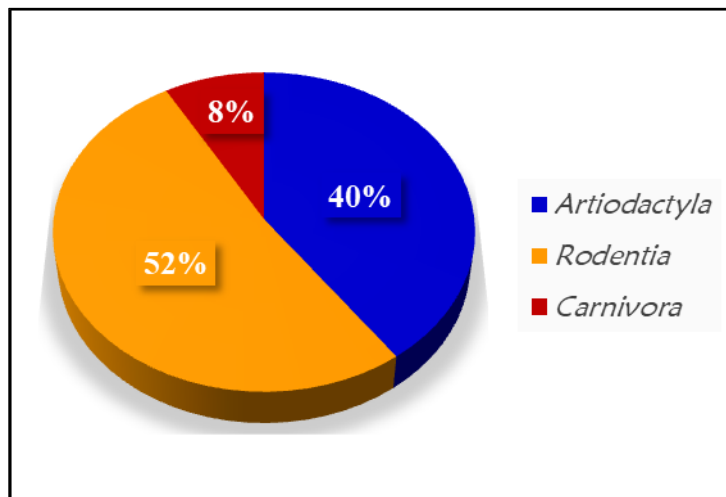
During this study, 60 animal presence signs (Figure 2) allowed the identification of 14 mammal species belonging to 9 families and 3 orders: *Artiodactyla*, *Rodentia*, and *Carnivora* in the Wadrékro Village forest. The order *Rodentia* (52%) was the most frequently encountered in this forest, followed by *Artiodactyla* (40%) and *Carnivora* (8%) (Figure 3).

At the species level, *Tragelaphus scriptus* and *Thryonomys swinderianus* were the most frequent (21.7%), followed by *Protoxerus stangeri* (16.7%), *Philantomba maxwellii* (8.3%), *Cricetomys gambianus* (8.3%), and *Cephalophus dorsalis* (5%). In contrast, *Xerus rutilus*, *Civettictis civetta*, and *Crossarchus obscurus* had relatively low encounter frequencies (3.3%). Other species, including *Cephalophus rufilatus*, *Potamochoerus porcus*, *Hippopotamus amphibius*, *Atherurus africanus*, and *Nandinia binotata*, were very poorly represented (1.7%).

All species were identified through indirect observations, except for *Protoxerus stangeri*, which was observed both directly and indirectly (Table 1).



**Figure 2** Some signs of mammal presence recorded in the Village forest



**Figure 3** Relative frequencies of presence signs by mammal orders

**Table 1** List of mammal species encountered in the Village forest

Order	Family	Commun Name	Scientific name	N	Obs	Fr (%)
Artiodactyla	Bovidae	Bushbuck	<i>Tragelaphus scriptus</i>	13	Indirect	21.7
		Red-flanked duiker	<i>Cephalophus rufilatus</i>	1	Indirect	1.7
		Black-backed duiker	<i>Cephalophus dorsalis</i>	3	Indirect	5
		Maxwell's duiker	<i>Philantomba maxwellii</i>	5	Indirect	8.3
	Suidae	Red river hog	<i>Potamochoerus porcus</i>	1	Indirect	1.7
	Hippopotamidae	Common hippopotamus	<i>Hippopotamus amphibius</i>	1	Indirect	1.7
Rotentia	Hystricidae	African brush-tailed porcupine	<i>Atherurus africanus</i>	1	Indirect	1.7
	Thryonomyidae	Greater cane rat	<i>Thryonomys swinderianus</i>	13	Indirect	21.7
	Nesomyidae	Gambian giant rat	<i>Cricetomys gambianus</i>	5	Indirect	8.3
	Sciuridae	Unstriped ground squirrel	<i>Xerus rutilus</i>	2	Indirect	3.3
		Giant forest squirrel	<i>Protoxerus stangeri</i>	10	Indirect/direct	16.7
Carnivora	Viverridae	African civet	<i>Civettictis civetta</i>	2	Indirect	3.3
	Herpestidae	Marsh mongoose	<i>Crossarchus obscurus</i>	2	Indirect	3.3
	Nandinidae	African palm civet	<i>Nandinia binotata</i>	1	Indirect	1.70

N: Number of observations or signs; Obs: Type of observation; Fr: Encounter frequency

### 3.2. Habitat Diversity Index

Table 2 presents the different diversity index values for the four types of habitats identified in the village forest. According to the Shannon index, the secondary forest is the most diverse habitat ( $H' = 2.026$ ), followed by the fallow land ( $H' = 1.615$ ). Finally, the cocoa fields ( $H' = 0.693$ ) and food crop fields ( $H' = 0.562$ ) come last. The Shannon indices differ significantly between most habitats ( $p$ -value=0.002). Regarding the mean Pielou evenness index ( $J = 0.88$ ), it reveals that species distribution is almost homogeneous within the habitat populations. There is no significant difference from one habitat to another ( $p$ -value=0.849).

**Table 2** Species richness and diversity index values across different habitats

Habitat Types	Number of Individuals	Species Richness (S)	Shannon Index (H')	Pielou index (J)
Secondary Forest (F)	20	10	2.026	0.88
Fallow Land (J)	34	7	1.615	0.83
Cocoa Field (C)	2	2	0.693	1
Food Crop Field (V)	4	2	0.562	0.811
Average	15	6	1.224	0.88
p-value	0,022	0,018	0,002	0,849

### 3.3. Conservation Status of Mammal Species

According to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the species *Nandinia binotata* is classified under Appendix I (AI). The species *Cephalophus rufilatus*, *Cephalophus dorsalis*,

*Philantomba maxwellii*, and *Hippopotamus amphibius* are listed in Appendix II (AII). The other mammal species are mentioned in Appendix III (AIII), including *Tragelaphus scriptus*, *Potamochoerus porcus*, *Atherurus africanus*, *Thryonomys swinderianus*, *Cricetomys gambianus*, *Xerus rutilus*, *Protoxerus stangeri*, and *Crossarchus obscurus*. Regarding the International Union for Conservation of Nature (IUCN, 2024) status, *Hippopotamus amphibius* is classified as Vulnerable (VU), while all other inventoried species are considered of Least Concern (LC) (Table 3).

**Table 3** Conservation Status of Mammals Inventoried in the Village Fores

Ordre	Famille	Nom commun	Nom scientifique	Statut de conservation	
				SN	SC
<i>Artiodactyla</i>	Bovidae	Bushbuck	<i>Tragelaphus scriptus</i>	AIII	LC
		Red-flanked Duiker	<i>Cephalophus rufilatus</i>	AII	LC
		Black-backed Duiker	<i>Cephalophus dorsalis</i>	AII	LC
		Maxwell's Duiker	<i>Philantomba maxwellii</i>	AII	LC
	Suidae	Bushpig	<i>Potamochoerus porcus</i>	AIII	LC
	Hippopotamidae	Common Hippopotamus	<i>Hippopotamus amphibius</i>	AII	VU
<i>Rotendia</i>	Hystricidae	African Brush-tailed Porcupine	<i>Atherurus africanus</i>	AIII	LC
	Thryonomyidae	Greater Cane Rat	<i>Thryonomys swinderianus</i>	AIII	LC
	Nesomyidae	Gambian Giant Rat	<i>Cricetomys gambianus</i>	AIII	LC
	Sciuridae	Palm Squirrel	<i>Xerus rutilus</i>	AIII	LC
		Giant Squirrel	<i>Protoxerus stangeri</i>	AIII	LC
<i>Carnivora</i>	Viverridae	African Civet	<i>Civettictis civetta</i>	AIII	LC
	Herpestidae	Brown Mongoose	<i>Crossarchus obscurus</i>	AIII	LC
	Nandinidae	African Palm Civet	<i>Nandinia binotata</i>	AI	LC

SN: National Protection Status (CITES); AI: Fully protected species; AII: Partially protected species; AIII: Hunting allowed within legally permitted limits; SC: Conservation Status according to the IUCN Red List; LC: Least Concern; VU: Vulnerable

#### 4. Discussion

This study assesses the mammalian fauna of a village forest in Wadrékro, revealing the presence of 14 mammal species. This observed species richness is significantly lower compared to the 21 mammal species recorded in the rural area of the Sipilou department [23]. The low species richness in the Wadrékro village forest may be related to its small area [26]. According to Béné et al. (2012) [13], larger study areas are more likely to exhibit high species richness due to the diversity of habitats and food sources available for mammals. However, the mammalian diversity in the Wadrékro village forest, like several other village forests, should not be underestimated. For instance, the forest relics in the Tonkpi Region [9] and Gbétitapéa [14], despite lacking specific protection status, have demonstrated significant conservation value for mammalian fauna. Indeed, well-conserved village forests are essential and should be integrated into wildlife management plans in Ivory Coast [27].

In this village forest, the orders Rodentia and Artiodactyla were the most frequently represented in terms of species. This may be explained by the fact that the distribution of mammal species in these two orders is generally conditioned by various environmental parameters. The availability of food resources, the diversity of natural habitats, and vegetation cover are environmental variables that influence the diversity and abundance of these mammal species [28, 29]. Additionally, reproductive factors are among the biological factors affecting the distribution of these species. Most previous studies on mammals [30, 31] have shown that species richness and abundance depend on habitat types. Other studies on mammals [30–32] have obtained similar results. The analysis of mammalian presence indices indicated that

the species *Tragelaphus scriptus* and *Thryonomys swinderianus* were the most abundant compared to other mammal species in this forest patch. This result aligns with findings from other studies that have observed similar abundances of these species in various types of natural habitats [20, 23, 31, 33]. The abundance of these species may be attributed to their varied diets and good adaptation to several habitat types, even those that are more disturbed [20, 23, 34, 35].

Furthermore, the presence indices of mammal species were significantly higher in the secondary forest and fallow land compared to other habitats in this village forest. These environments also exhibited the greatest species richness, demonstrating that many mammal species prefer less disturbed habitats due to human activities. These closed habitats provide a refuge for the remaining mammalian fauna against various human pressures in the study area. Human activities not only reduce and fragment wildlife habitats but also diminish food resources in the natural environment. Consequently, mammalian fauna tends to forage in the secondary forest and fallow land, leading to an increasing number of mammal species in these habitats. The strong presence of mammals in the secondary forest and fallow land is a recurring observation in Ivory Coast [23].

According to the criteria of the International Union for Conservation of Nature (IUCN, 2024), the species *Hippopotamus amphibius* recorded during this study is classified as vulnerable (VU). Referring to CITES Appendices, the species *Nandinia binotata* is listed in Appendix I (AI). Therefore, these two species could be selected as flagship species for fundraising efforts aimed at conserving this village forest. Conservation actions for this village forest fragment could help protect numerous animal species of particular concern [7, 23, 36].

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## 5. Conclusion

The Wadrékro village forest harbors significant mammalian richness dominated by species found in the better-conserved areas of the country. This forest fragment is home to the Common Hippopotamus (VU) and the African Palm Civet (AI), which are globally significant for conservation. Despite lacking any legal protection status, village forests play a vital role in combating biodiversity degradation, particularly concerning mammalian fauna. It is crucial for local populations and national wildlife conservation managers to pay particular attention to these forests in order to safeguard them.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

All authors of this manuscript confirm that they have no conflicts of interest or competing interests related to its publication.

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