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HABITAT AND THREATS TO THE ARBOREAL PANGOLIN POPULATION (*PHATAGINUS TRICUSPIS*) IN THE MONT KOUFFÉ PROTECTED FOREST (BENIN)

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ABSTRACT

In Benin, due to habitat disturbance due to strong anthropogenic pressure, some pholidote species have become vulnerable or even threatened, as is the case with tree pangolins. Thus, the problem of wildlife conservation, especially that of pholidotes, becomes worrying. The overall objective of the study is to determine the preferred habitats and threats to the tree pangolin population in the Monts Kouffé protected forest.

The method used to collect biogeographical data is based on surveys followed by forest surveys and interviews with the local population. Thus, clues of the presence of *Phataginus tricuspis* (smell of the animal, tree cavities, claws of the animal against trees in savannah, open forest, dense dry forest and gallery forest in the hunting areas of Manigri Ikanni, Manigri Oké, and Agbassa) were sought and this through excavations in the savannahs. The Menly Alpha Habitat Preference Index was calculated to determine the habitat preference of the tree pangolin and the frequency of threat observations on this animal population. The species frequents open forests, gallery forests, dense-dry forests, wooded savannahs, shrub savannahs. But nevertheless, it has a strong preference for dense dry forests with the Menly alpha index equal to 0.8. The decline of the species' populations is facilitated by several factors that constitute direct or indirect threats affecting the distribution of the species. These threats are: deforestation (49.05%), illegal hunting (22.64%), human occupations (13.20%), transhumance (7.54%) and wildland fires (7.54%).

Keywords: Mammal, threat, pangolin, Mont Kouffé, Bassila

1. INTRODUCTION

Wildlife is a heritage to be passed on to future generations (Fichant, 2011). It is one of the most valuable, exploited and threatened resources (Boulweydou, 2008).

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Indeed, most studies conducted on fauna in Benin are of a general nature, integrating several orders of mammals (case of counts and monitoring), or address the study of a few specific orders according to their importance, their usefulness or according to the urgency of conservation according to IUCN criteria. The focus is generally on large fauna (Di Silvestre, 2004; Sogbohossou, 2006), which considerably reduces knowledge about the small, which, as a result, is not specifically integrated into management plans (Mouzoun, 2014).

The pangolin belongs to the order of pholidotes. They form an order of mammals that includes several families, only one of which is not extinct but is decimated, that of the pangolins (IFAW, 2017). The pangolin is a species fully protected by Law No. 2002-16 of 18 October 2004 on the fauna regime in the Republic of Benin. Since 2017, the pangolin has become the most poached mammal in the world (IFAW, 2017). Thirty-one thousand (31,000) kg of pangolin scale have been seized worldwide according to the International Fund for Animal Welfare (IFAW, 2017).

All african pangolin species are threatened by hunting for local markets (Waterman *et al.* 2014a, b, c; Pietersen *et al.*, 2014).

Three species of pangolins are present in West Africa where it is estimated that 80% of the original forest has been converted to an agricultural mosaic, representing an estimated loss of 10 million hectares of forest in the twentieth century (Norris *et al.*, 2015).

Little is known about the ecology or behavior of pangolin species. However, based on the available data, pangolins are very vulnerable to overexploitation due to their low reproductive rate (1 pup per year, and 2 pups on rare occasions). Manis temminckii is the best studied of all African species, yet little is known about the biology of this species in the wild (Pietersen *et al.* 2014b).

Africa has one of the highest rates of primary forest loss in the world (FAO 2010), and deforestation is considered an additional factor in the decline of pangolin populations especially in the western and central parts of the continent.

The Nigerian Management Authority noted that pangolins have almost completely disappeared from the habitat of the savannah and other northern parts of Nigeria (E. Ehi-Ebewele, Deputy Director, Federal Dept. of Forestry, Nigeria, pers. comm. February 2016).

According to Gorgen *et al.*, 1996, poaching, extensive agriculture, extensive and uncontrolled urbanization of certain regions, forestry and mining cause the scarcity of wildlife that was once one of the most important sources of protein for people in sub-Saharan Africa.

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In the Classified Forest of Monts Kouffé (FCMK), *Phataginus tricuspis* went from 8 individuals on an area of 28,000 ha (Maniri Ikanni hunting area) in 2016 to 5 individuals on an area of 75,000 ha (Manigri Oké, Manigri Ikanni and Agbassa hunting area) in 2018 (Dotché, 2018). This reduction in the number of *Phataginus tricuspis* is due to habitat loss, uncontrolled grazing and poaching. In this area, wildlife conservation is less important (PAMF, 2006). Hunting is not controlled. The most vulnerable and useful animals are the most exposed to poaching (Dotché, 2016).

The FCMK, a densely forested area, was rich in mammals (Sayer *et al.* 1984). But in the face of the economic crisis, the exploitation and marketing of wood is a very fruitful alternative for the local population. Thus, despite the existence of a management plan, the FCMK is subject to strong pressures from slash-and-burn agriculture, uncontrolled logging, uncontrolled grazing and poaching. These anthropogenic activities have negative effects on flora and fauna.

Hence the present study focuses on "the habitat of the arboreal pangolin and the threats to the species in the classified forest of Monts-Kouffé".

1.1 Geographical location of the FCMK

The FCMK lies between the parallels 8° 30` 11.4`` and 8° 51` 39; 47.4`` north latitude and the meridians 1° 38` 09.3`` and 2° 16` 23.3`` east longitude. It is bounded to the north by the classified forest of Wari-Maro and the Odola River, to the east by the Ouémé River, to the west and south by the Adjiro River. Figure 1 shows its location.

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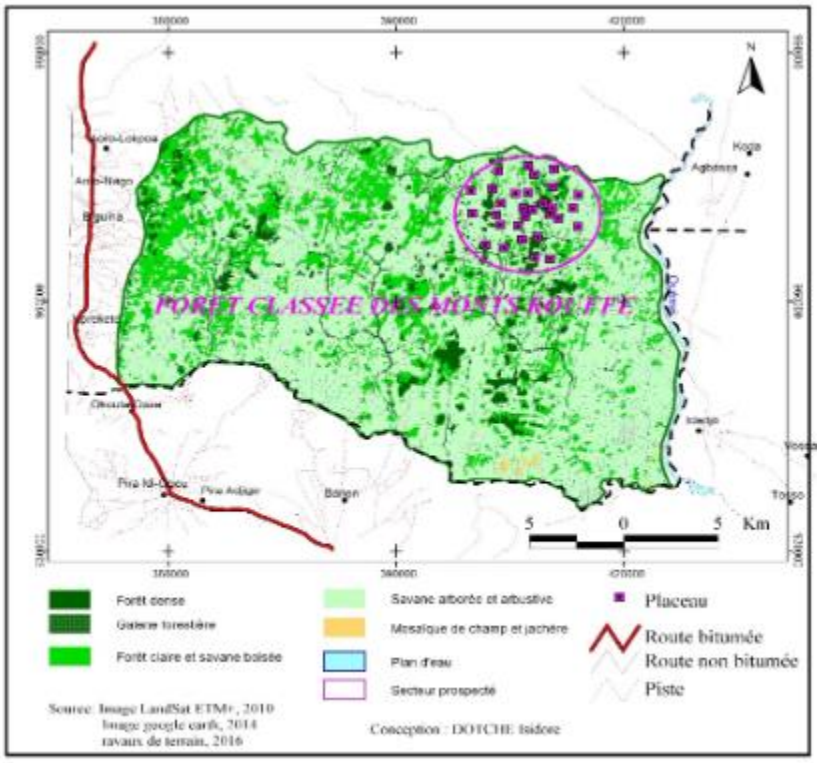

Figure 1: Location of the classified forest of the Kouffé Mountains

1.2 Biophysical and human aspects of the study environment

The climate of the environment is Sudano-Guinean, characterized by two main seasons: a rainy season Precipitation, evapotranspiration and temperature are elements of the climate that influence the fauna of this classified forest.

In the classified forest of the Monts Kouffé, three types of soil are distinguished: sandy or sandy-loamy ferruginous soils with gravel load with a very modest forest potential (55%); red-brown or rust-brown ferralitics with low or medium quench thirst with gravel load, clayey at depth (25%); hydromorphic soils with low humiferous Gley or pseudogley, with marked horizontal differentiation, at useful depth sometimes limited by a lateritic shell (20%). These soils have very diverse textures. Their forest potential is generally considered good (PRRF, 2001).

2. METHODOLOGICAL APPROACH

The methodological approach is necessary in order to better guide the investigations. It presents the data used, the methodological approaches adopted including the main stages of data

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collection (documentation, field surveys), their processing, and the analysis of the results. The data used are demographic, biogeographical, cartographic, satellite and ethnozoologiques.

Several materials contributed to the collection of data, the interview guide, the questionnaire, as well as tools such as GPS, penta-decameter.

2.1 Habitat Determination Methodology in the FCMK

In order to study the habitat of the species in the FCMK, forest surveys have identified its presence in the different plant formations (dense-dry forest, open forest and wooded savannah, wooded savannah, shrub savannah, degraded forest of the FCMK).

The study of the relationships between the presence of the tree pangolin and its habitat was carried out using the stations (plots) installed. Fifty-five (55) sites (plots) were used in the analysis with fairly global descriptive variables.

2.2 Determination of the distribution area of pangolin in the FCMK.

The surveys were made between 10 p.m. and 5 a.m. The following data were collected the dendrometric measurements (dbh and height of woody trees in the plot) were collected: species footprints, soil types, altitude, types of plant formations where these indices were found. These different data were systematically georeferenced by means of a GPS (Gobal Positioning System). The identification of the prints was done with the support of the guides.

- ✓ **Vegetation sampling**

The FCMK has an area of 2010 km² or 273,000 ha. It is subdivided into 11 hunting areas. The work was carried out in the hunting areas on the Bassila side. Fifty-five (55) plots spread over the hunting areas of the reserve on the Bassila side. These are the hunting areas of Manigri Oké (25,000 ha), the hunting area of Manigri Ikani (28,436 ha), the hunting area of Agbassa-Olougbé (14,150 ha).

The collection of information was carried out within a plot of 30 m radius (2826 m2), the diameter at chest height (dbh) of the trees, the height of the trees was noted. Contact with the species as well as evidence of presence were noted. The distance from the point of the presence index to the nearest watercourse was noted. At the scale of the plot, the closure of the vegetation cover as well as the ecological type were visually assessed. The presence of particular abiotic characteristics is also specified (passage of a watercourse, wetland).

- ❖ **Real-world investigation methods:**

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Due to the nocturnal and discreet habits of the animal and their limited period of activity, it is more effective to locate pangolin populations using presence cues such as: two-cavity trees, claws of the animal on trees, the smell of pangolin in termite mounds and in the hollows of trees as well as direct observation of the pangolin. Scales charred by wildland fires have also been observed in the reserve.

- **Identification of habitat types frequented by the species in the FCMK**

The preferred habitats of the species are defined by calculating the percentage of observation of presence indices according to the different habitat types such as savannahs (shrubs, trees), gallery forests, open forests and dense-dry forests using the full data (GPS coordinates). The data are processed for the purpose of determining the frequency of occurrence and the preference index.

Frequency of occurrence of a species (Damnergie, 2008)

It is the ratio expressed as a percentage of the number of samples in which this species is recorded to the total number of samples taken (Damerdji 2008).

Its expression is as follows:

$$F = Pa / P * 100$$

3. Results

3.1 Habitat of *Phataginus tricuspis* in the of Monts Kouffé protected forest

3.1.1 Types of habitats frequented

The distribution of observations by habitat type showed the presence of *Phataginus tricuspis* by direct and indirect contact in wooded savannas (26.41%), shrub savannas (49.05%), open forests (11.32%) forest galleries (05%) and degraded dry dense forests (3.77%). Figure 5 shows the proportions of plant formations frequented by the species.

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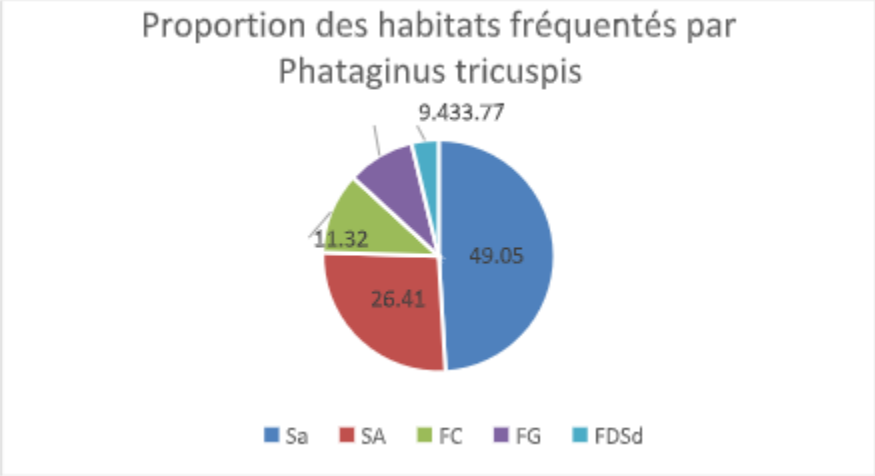

Figure 5: Proportion of habitats frequented by *Phataginus tricuspis* in the FCMK

Source: Field survey, April, 2018

This figure shows that *Phataginus tricuspis* frequents forest formations (gal e forests, open forests and dense-dry degraded forest) and savannah formations (shrub savannas and wooded savannahs).

The calculation of Manly's alpha indices makes it possible to know the preferential habitats.

Preferred habitat

The calculation of Manly alpha indices for habitat selection for the five habitat types present in the reserve, wooded savannah, shrub savannah, forest gallery, degraded dense dry forest and open forest, was done. Table VIII presents the alpha value indices of Manly for each habitat. In this table the comparison of αi is made with respect to m = 5 is the number of habitats available. So, 1 / m = 0.2.

Table VIII: Manly alpha index value for different habitat types

Habitat types	Manly Alpha Value Indices	Habitat used (Preferred/avoided)
Wooded savannah	αSA=0.01 < 1/m	Evity
Savannah shrubs	αSa=0.017 <1/.m	Evity
Open forest	α FC=0,06<1/m	Evity
Degraded dense dry forest	αFDSd=0,8>1/m	Favourite
Galerie forest	αFG=0.16 <1/m	Evity

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Analysis in Table VIII shows that the MKFC contains habitats that support Phataginus triscuspis. While considering Menly's alpha values, wooded savannahs, shrub savannahs, open forests, gallery forests are habitats avoided by Phataginus triscuspis. Only dense dry forests are preferred. This is explained by the fact that the SDF being almost in the middle of the prospected areas is more spared from activities around the reserve. Especially since 2/5 of the individuals of the animal were captured in the SDF. The Menly value of the habitat of galeries forests is equal to 0.16 close to 0.2. The species likes to live along streams; transhumant Puhl scamps have been observed near the Idjisin, Odo-Agan and Djoffo rivers. This state of affairs disturbs the tranquility of the fauna especially pangolins which have a very high degree of stress when they feel the presence of a foreign individual especially man.

Figure 6 shows the trees used by pangolins

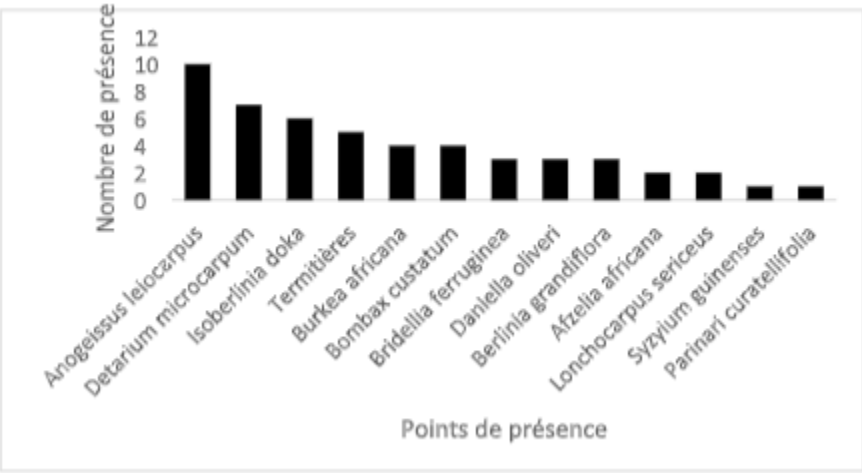

Figure 6: Tree species with pangolins From the exploitation of this graph, it appears that *Anogeissus leiocarpa, Detarium microcarpium, Isoberlinia doka, Burkea africana* are the tree species most used by the animal species.

Different forms of pressure on the species in the FCMK

The decline in populations of *Phataginus tricuspis* is facilitated by several factors that constitute direct or indirect threats affecting the distribution of the species. These threats are: deforestation (49.05%), illegal hunting (22.64%), human occupations (13.20%), transhumance (7.54%) and wildland fires (7.54%). Figure19 shows the frequency of these threats to animals in the study area.

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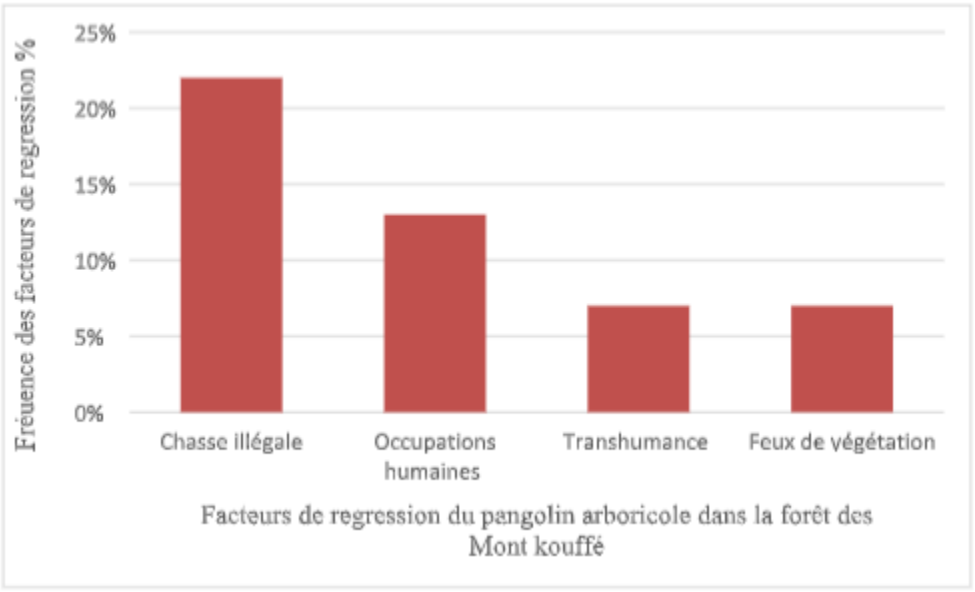

Figure 4: Frequencies of regression factors of *Phataginus tricuspis*.

Overall, deforestation isidentified in the FCMK as the main source of the decline in the population of *Phataginus tricuspis* (49.05%). Then come illegal hunting (22.64%), human occupations (13.20%). They are followed by transhumance (7.54%) and wildland fires (7.54%).

The following photos illustrate the threats to the population of the species in the classified forest of Monts Kouffé.

***Daniellia oliveri* cut in the FCMK**

Source: Dotted shot, 2018

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Traffic of Phataginus .tricuspis in the FCMK

Photo: Human occupation around the FCMK

Photo: Wildland fires in the study area

Plate 1: Threats to the population of *Phataginus tricuspis* in the classified forest of Monts Kouffé.

Source: Dotted shot, 2018

Photo (a) shows deforestation in the FCMK, photo (b) shows illegal hunting, photo (c) shows settlements in Koumassi, a hamlet located 2 km from the Manigri Oké hunting area, photo (d) shows wildfires in the study area.

CONCLUSION

The pangolin frequents open forests, gallery forests, dense-dry forests, wooded savannahs, shrub savannahs. Although the species frequents forest formations and savannah formations, it avoids wooded savannahs, shrub savannahs, open forests, gallery forests but nevertheless prefers dense dry degraded forests. It selects several types of trees, the most preferred of which are *Anogeissus leiocarpa, Detarium microcarpum, Isoberlinia doka.*

Urgent action is needed to conserve the pangolin sustainably in its habitat.

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