

1 Conservation status of endangered wildlife: the case of the pangolin 2 in a community forest and two classified forests in the Tonkpi region, 3 Western Côte d'Ivoire.

4

5 1. Abstract

6 Wildlife is an essential component of global biodiversity. Among the animal species
7 most threatened with extinction is the pangolin. This insectivorous mammal belongs
8 to the order Pholidota. It is considered the most illegally trafficked mammal in the
9 world due to the growing demand for its meat and scales. This study aims to assess
10 the conservation status of the pangolin in three forests in western Côte d'Ivoire, in
11 order to better understand its distribution, preferred habitats, and the threats facing
12 this animal species. Ethnological surveys and reconnaissance walks (RECCE) were
13 conducted to inventory pangolin species in the field. This study was carried out in
14 four habitat types: humid dense forests, mountain dense forests, dry dense forests, and
15 anthropogenically modified forests. The pangolin species identified during this study
16 were *Phataginus tetradactyla* and *Phataginus tricuspis*. Pangolin species could be
17 detected directly or indirectly. Direct observations included any visual contact with
18 the animals during our fieldwork. Indirect observations encompassed all indirect
19 indicators that could definitively confirm the presence of pangolins at the study site.
20 During the study, 89 pangolin signs were recorded, including 66 (74.16%) signs of
21 *Phataginus tricuspis* and 23 (25.84%) signs of *Phataginus tetradactyla*. These two
22 pangolin species have essentially the same distribution ranges. They are generally
23 observed in forest habitats, particularly in mountainous areas. The sustainable
24 conservation of these mammals in western Côte d'Ivoire is threatened by human
25 activities, including agriculture, hunting, logging, and bushfires.

26 **Keywords:** *Bushmeat, Pangolin, Forests, Mammals, Côte d'Ivoire*

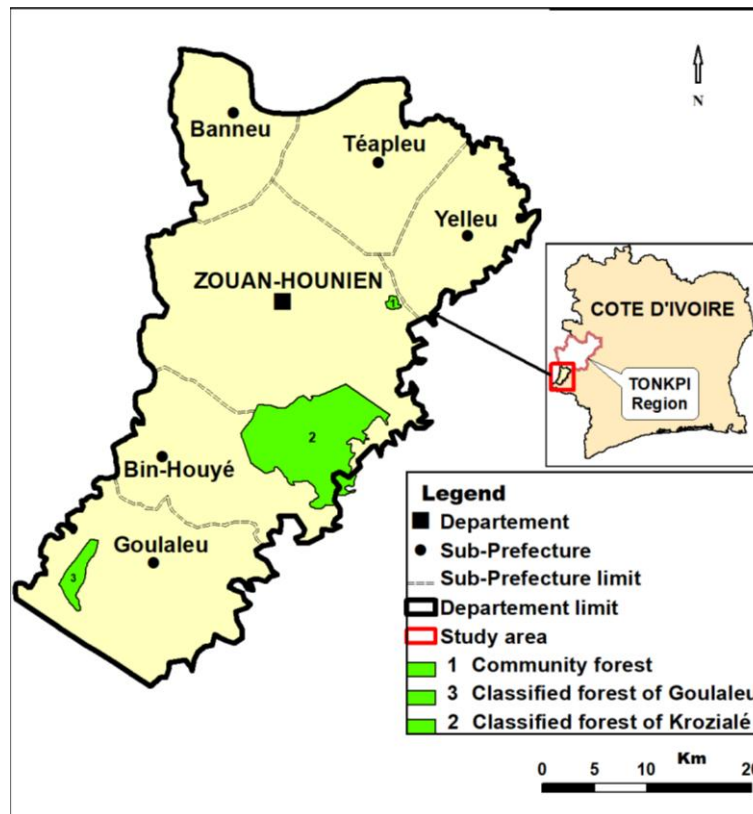
27 2. Introduction

28 Wildlife is an essential component of global biodiversity. It plays a fundamental role
29 in maintaining the ecological balance of forest ecosystems (Archer et al., 2021). This
30 biodiversity is currently experiencing an unprecedented crisis, marked by an alarming
31 rate of animal species extinction, largely attributable to human activities (Heinrich et
32 al., 2017; Kouassi et al., 2023). Among the most threatened animal species is the
33 pangolin. This insectivorous mammal belongs to the order Pholidota (Gaubert et al.,

34 2016). It is considered the most illegallytrafficked mammal in the world due to the
35 growingdemand for its meat and scales(Challender et al., 2015; Heinrich et al.,
36 2017).Its scales are used in some traditional Asian and African
37 pharmacopoeias(Zanvo et al., 2021). The pangolin is listed in the appendices of the
38 Convention on International Trade in Endangered Species of Wild Fauna and Flora
39 (CITES) (Challender & Waterman, 2017) and classified as Vulnerable, Endangered,
40 or Critically Endangered on the IUCN Red List of Threatened Species. In sub-
41 Saharan Africa, and more specifically in Côte d'Ivoire, the pressure exerted on forest
42 ecosystems by extensive agriculture, logging, and poaching directlythreatens the
43 pangolin's natural habitats (Sidibé et al., 2020).Although the COVID-19 pandemicin
44 2020 caused a temporary disruption to urban wildlife supply networks, the bushmeat
45 trade remains a major threat contributing to the decline of its populations (Gossé et
46 al., 2023). The Tonkpi region, located in western Côte d'Ivoire, is an important but
47 highly fragmented biodiversity refuge where the pangolin population is declining,
48 particularly in community and classified forests. Forest management in this region is
49 heterogeneous, fluctuating between "classified forests" under state control and
50 "community forests" managed through customary practices (Kadet, 2015). Although
51 the pangolin is protected by international conventions (CITES) and Ivorian
52 legislation, scientific data on its actual conservation status in Tonkpi remains limited.
53 The central issue, therefore, lies in assessing the impact of protection status on the
54 persistence of pangolin populations in a fragmentedlandscape. However, weak
55 monitoring measures, the use of non-selective hunting tools, and the uncontrolled
56 exploitation of natural resources severelyjeopardize the survival of animal
57 populations, especially the pangolin. In light of this situation, our study aims to assess
58 the conservation status of the pangolin in these three forests of the Tonkpi region, (i)
59 in order to better understand its distribution, (ii) its preferred habitats, and (iii) the
60 threats facing this animal species. Our study will contribute to the improvement of
61 appropriate sustainable wildlife management policies in this forest region.

62 **3. Methodology**

63 **3.1 Study site**



64

65 **Figure 1** : Geographical location of the study area

66 **3.2 Data Collection Methods**

67 **3.2.1 Investigation**

68 An ethnozoological survey (Din et al., 2022) was conducted among local communities
 69 with proven knowledge of mammalian wildlife in general, and the pangolin in
 70 particular, in the villages surrounding the three studied forests. During the survey, we
 71 showed a pre-selected sample of different pangolin species likely to be present in the
 72 Tonkpi region. Several other pangolin images (Ingram et al., 2019; Morton et al.,
 73 2021) not known in Côte d'Ivoire were also presented to the participants to assess the
 74 reliability of identification based on the photographs. The survey first allowed us to
 75 compile a list of pangolin species that could be encountered, and then to identify the
 76 forests that might still harbor these wild animals.

77 **3.2.2. Foot prospecting**

78 In classified forests and the community forest, foot surveys were conducted at night.
 79 A single foot survey method was used, employing torches and machetes to facilitate
 80 movement (Din et al., 2022). This method was the reconnaissance walk method
 81 (RECCE) (Kadjo et al., 2014; Hoppe-Dominik et al., 2011). This method was applied

82 to increase sampling efforts and cover areas of potentially high diversity and density,
83 as well as to increase our chances of detecting multiple pangolin individuals. During
84 the reconnaissance walks, we followed a predetermined route, but one that allowed
85 for deviations during the foot surveys. RECCE had the advantage of allowing the
86 team to cover more areas in a short period of time, while minimizing environmental
87 impact(Walsh and White, 1999). Using GPS and a compass, we walked slowly at a
88 speed of 0.5 to 1 km/h to collect data on the presence of pangolins. Pangolin species
89 could be detected directly or indirectly. Direct observations included any visual
90 contact with the animals during our movements. Indirect observations encompassed
91 all indirect indicators that could definitively confirm the presence of pangolins at the
92 study site. Whenever evidence of pangolin presence was found, the inventory team
93 stopped to characterize it and record its geographic coordinates. During the walking
94 surveys, we also recorded evidence of human activities such as agriculture, logging,
95 hunting, and bushfires. All observations were recorded on a walking inventory form to
96 facilitate data analysis.

97 **3.2.3 Data analysis**

98 Two software programs, PAST (2.17c) and QGIS (2.14.7), were used for data
99 analysis. PAST (2.17c) was used to perform correspondence analyses to identify
100 preferred pangolin habitats. QGIS (2.14.7) was used to create maps of the spatial
101 distribution of pangolin species in the Daapleu community forest, the Goulaleu
102 classified forest, and the Krozialé classified forest. Excel was used to analyze the
103 frequency of human threats to pangolin individuals.

104 **4. RESULTS**

105 A total of 89 pangolin presence indicators were recorded in the three forests,
106 including 70 indirect indicators (78.66%) and 19 direct indicators (21.34%). The
107 indicators of presence were primarily feeding sites, burrows, and visual observations.
108 The Krozialé classified forest recorded the highest number of indicators (60.67%; N =
109 54), followed by the Goulaleu classified forest (25.85%; N = 23), and then the
110 Daapleu community forest (13.48%; N = 12).

111

112



113

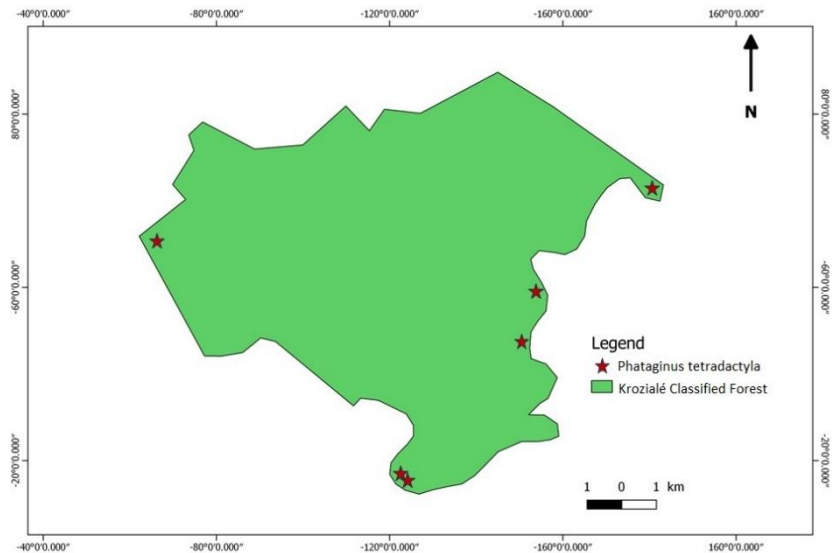
114 **Figure 1.** Illustration of the Pangolin (*Phataginus tricuspis*) in the studied forests,
115 Ivory Coast

116 **Spatial distribution of the pangolin in the studied forests**

117 ✓ **Krozialé Classified Forest**

118 In the Krozialé classified forest, 57 signs of Pangolin presence were recorded in this
119 forest during our study. During the collection of data on Pangolins in the classified
120 forest of Krozialé, there were 43 indirect observations (75.44%) and 14 direct
121 observations (24.56%). The Krozialé classified forest, with an area of 9,300 hectares,
122 contains individuals of Pangolin. These Pangolin individuals belong to two species.
123 These are the species *Phataginus tetradactyla* (Figure 2) and the species *Phataginus*
124 *tricuspis* (Figure 3). The species *Phataginus tetradactyla* is observed in the east, south
125 and west of the forest. However, its observation frequency is higher to the east of the
126 forest. As for *Phataginus tricuspis*, it is observed in the East, South, Center and West
127 of the forest. Its observation frequency is also higher to the east of the forest.
128 Although having approximately the same distribution areas, *Phataginus tricuspis* has
129 a higher observation frequency compared to that of *Phataginus tetradactyla* which
130 has not been observed in the center of the Krozialé classified forest.

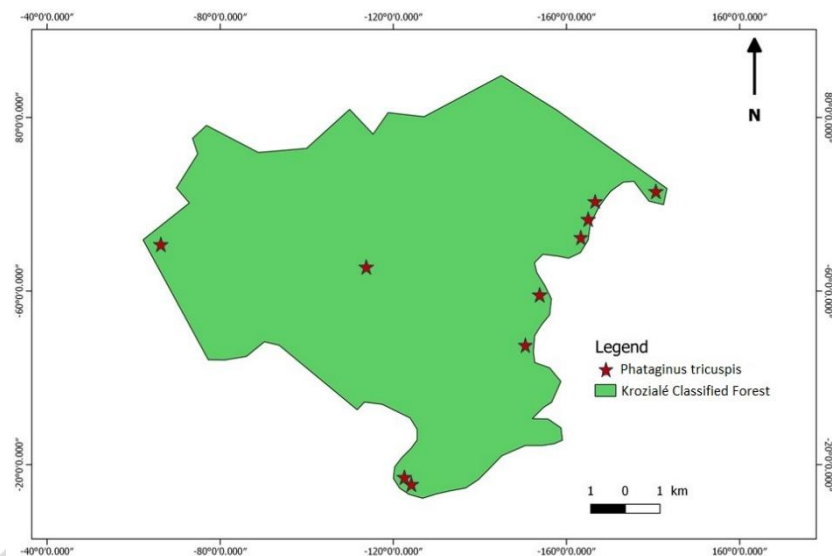
131



132

133 **Figure2.**Spatial distribution of *Phataginus tetradactyla* in the classified forest of
 134 Krozialé, Côte d'Ivoire

135



136

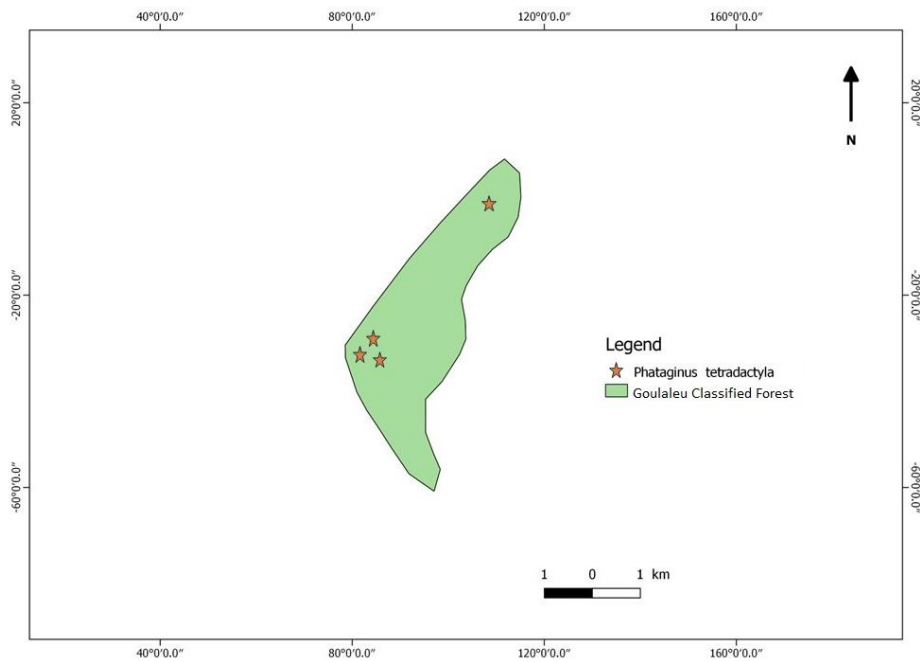
137 **Figure3.**Spatial distribution of *Phataginus tricuspis* in the classified forest of
 138 Krozialé, Côte d'Ivoire

139 ✓ **Goulaleu Classified Forest**

140 Within the Goulaleu Classified Forest, 23 pangolin presence indicators were recorded
 141 during our study. During data collection on pangolins in the Goulaleu Classified
 142 Forest, there were 18 indirect observations (78.26%) and 5 direct observations
 143 (21.74%). The Goulaleu Classified Forest, covering an area of 950 hectares, is home
 144 to several pangolin individuals. These pangolins belong to two species: *Phataginus*
 145 *tetradactyla* (Figure 4) and *Phataginus tricuspis* (Figure 5). These two mammal

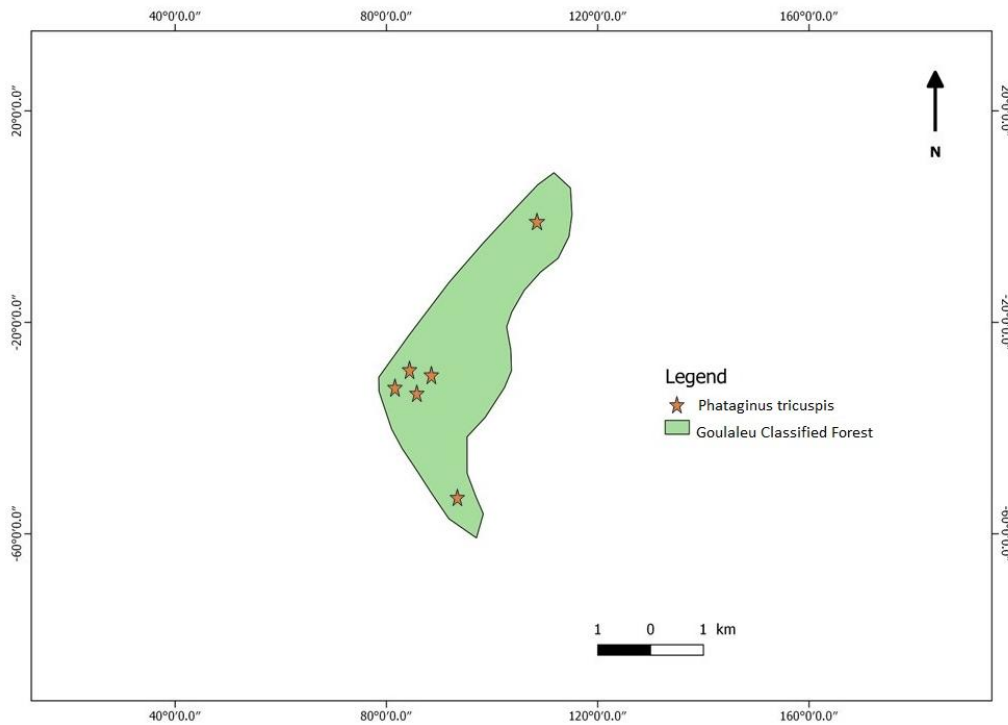
146 species have virtually the same distribution. However, in terms of specificity,
147 *Phataginus tetradactyla* is observed in the north and west of the Goulaleu Classified
148 Forest, while *Phataginus tricuspis* is observed in the north, west, and south of the
149 forest. These two species of Pangolin are observed further west of the classified forest
150 of Goulaleu.

151



152

153 **Figure4.** Spatial distribution of *Phataginus tetradactyla* in the classified forest of
154 Goulaleu, Côte d'Ivoire

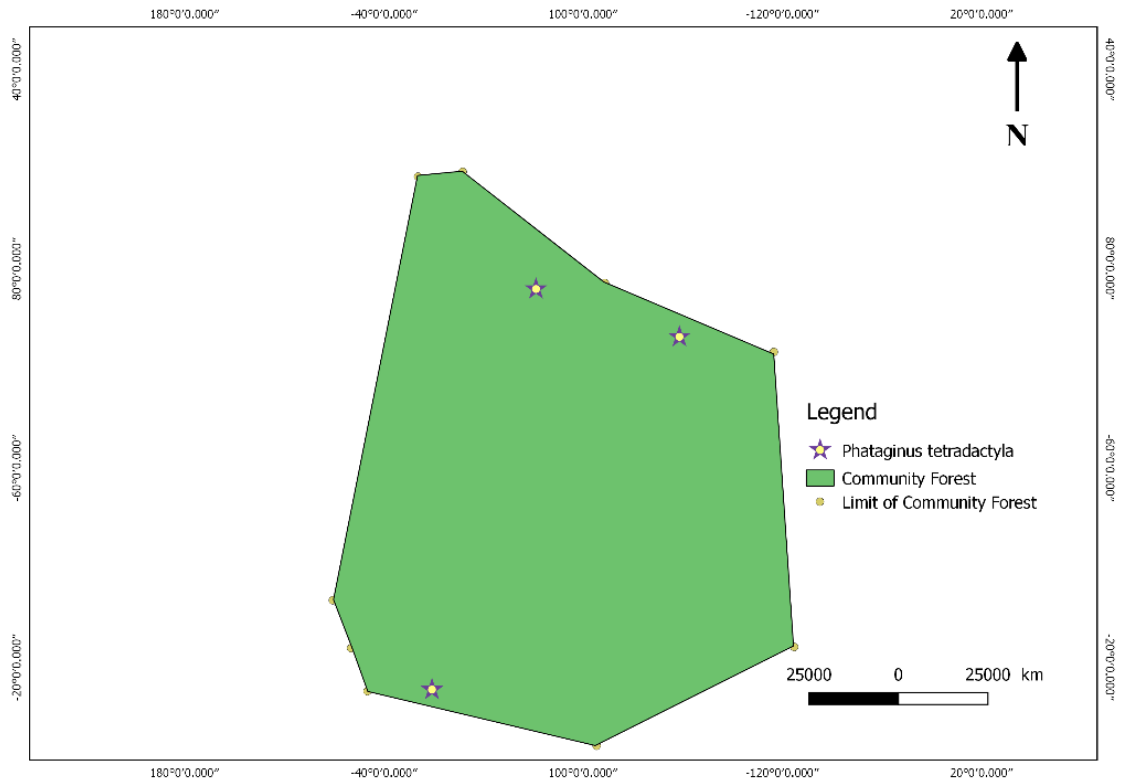


155

156 **Figure 5.** Spatial distribution of *Phataginus tricuspis* in the classified forest of
 157 Goulaleu, Côte d'Ivoire

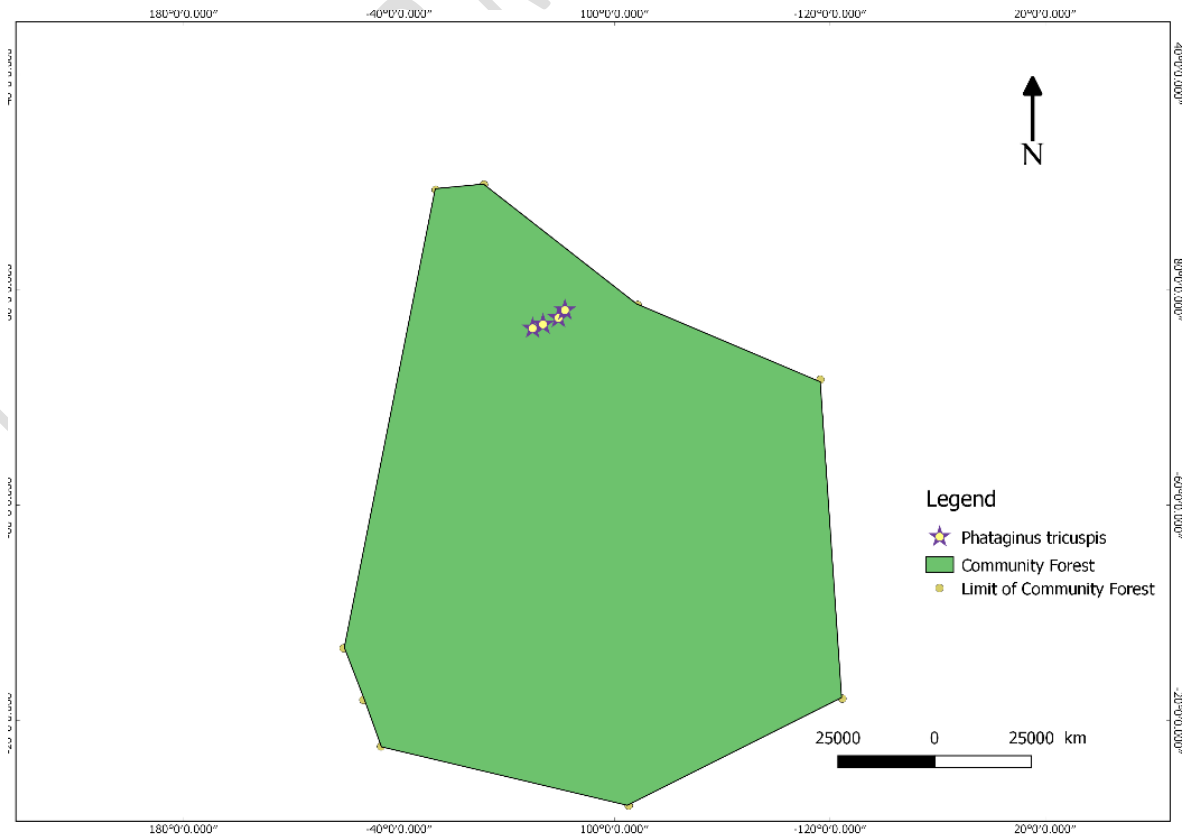
158 ✓ **Daapleu Community Forest**

159 In the Daapleu community forest, 12 pangolin presence indicators were recorded
 160 during the study. Data collection on pangolins in the Daapleu community forest
 161 revealed 9 indirect observations (75%) and 3 direct observations (25%). The Daapleu
 162 community forest, covering an area of 170 hectares, contains pangolins belonging to
 163 two species: *Phataginus tetradactyla* (Figure 6) and *Phataginus tricuspis* (Figure 7).
 164 *Phataginus tetradactyla* is found in the northeast, east, and southwest of the Daapleu
 165 community forest. *Phataginus tricuspis* is found only in the northern part of the
 166 forest.



167
168
169
170
171

✓ **Figure 6.** Spatial distribution of *Phataginus tetradactyla* in the Daapleu community forest, Côte d'Ivoire



172

173 **Figure 7.**Spatial distribution of *Phataginus tricuspis* in the Daapleu community
174 forest, Côte d'Ivoire

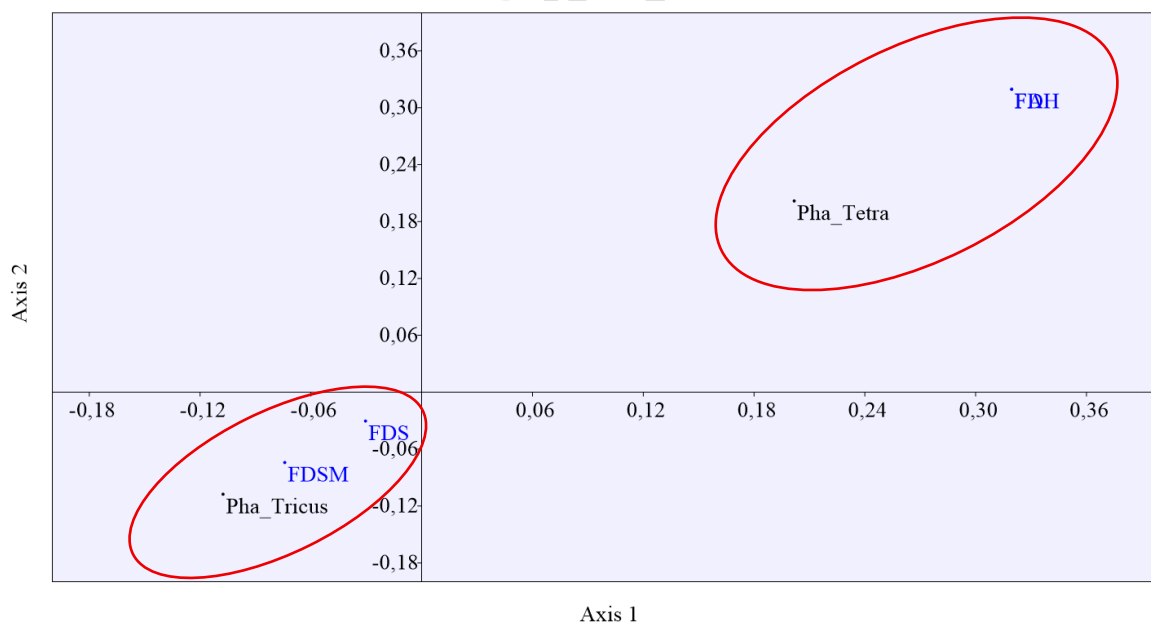
175 **Distribution of the pangolin in forests according to habitats**

176 During our study in the Krozialé and Goulaleu classified forests, and later in the
177 Daapleu community forest, four different habitat types were identified : Dense Humid
178 Forest (DHF), Dense Mountain Forest (DMF), Dense Dry Forest (DDF), and
179 Anthropogenic Forest (AF). At least one pangolin individual was identified in each of
180 these habitats.

181 ✓ **Krozialé Classified Forest**

182 In the Kroziale classified forest, the species *Phataginus tricuspis* is found in both
183 Dense Mountain Forest (DFSF) and Dense Dry Forest (DDF). However, it is more
184 commonly found in the Dense Mountain Forest (DFSF) habitat. As for *Phataginus*
185 *tetradactyla*, it is found in both Dense Humid Forest (DHF) and Anthropogenic Forest
186 habitats within the Kroziale classified forest (Figure 8).

187



188

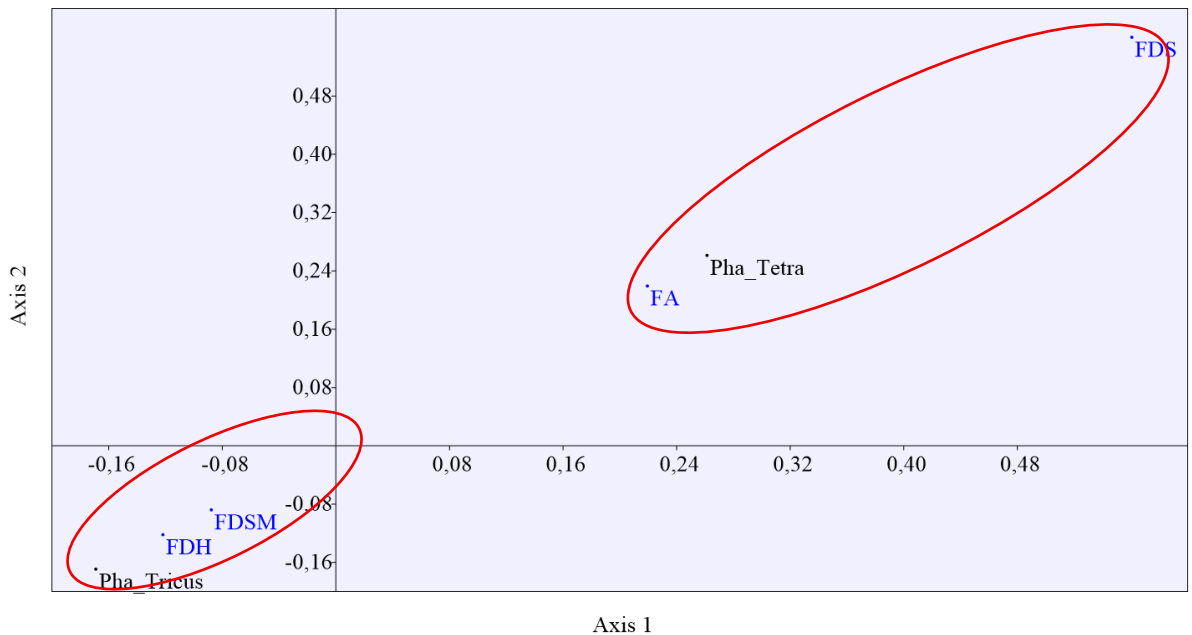
189 **FDH** = Dense Humid Forest; **FDSM** = Dense Mountain Forest; **FDS** = Dense Dry Forest; **FA** =
190 Anthropogenic Forest; **Pha_Tricus** = *Phataginus tricuspis*; **Pha_Tetra** = *Phataginus tetradactyla*
191

192 **Figure 8.**Distribution of the Pangolin in the Krozialé classified forest according to
193 habitats,Côte d'Ivoire

194

195 ✓ **Goulaleu Classified Forest**

196 In the Goulaleu classified forest, the species *Phataginus tricuspis* is found in the
 197 Dense Mountain Forest (FDSM) and Dense Humid Forest (FDH) habitats. However,
 198 the species is more frequently observed in the Dense Mountain Forest (FDSM)
 199 habitat. As for *Phataginus tetradactyla*, it is found in the Dense Dry Forest (FDS) and
 200 Anthropogenic Forest (FA) habitats. The species *Phataginus tetradactyla* is more
 201 frequently observed in the Anthropogenic Forest (FA) habitat within the Goulaleu
 202 classified forest (Figure 9).



203

204 **FDH** = Dense Humid Forest; **FDSM** = Dense Mountain Forest; **FDS** = Dense Dry Forest; **FA** =
 205 Anthropogenic Forest; **Pha_Tricus** = *Phataginus tricuspis*; **Pha_Tetra** = *Phataginus tetradactyla*

206

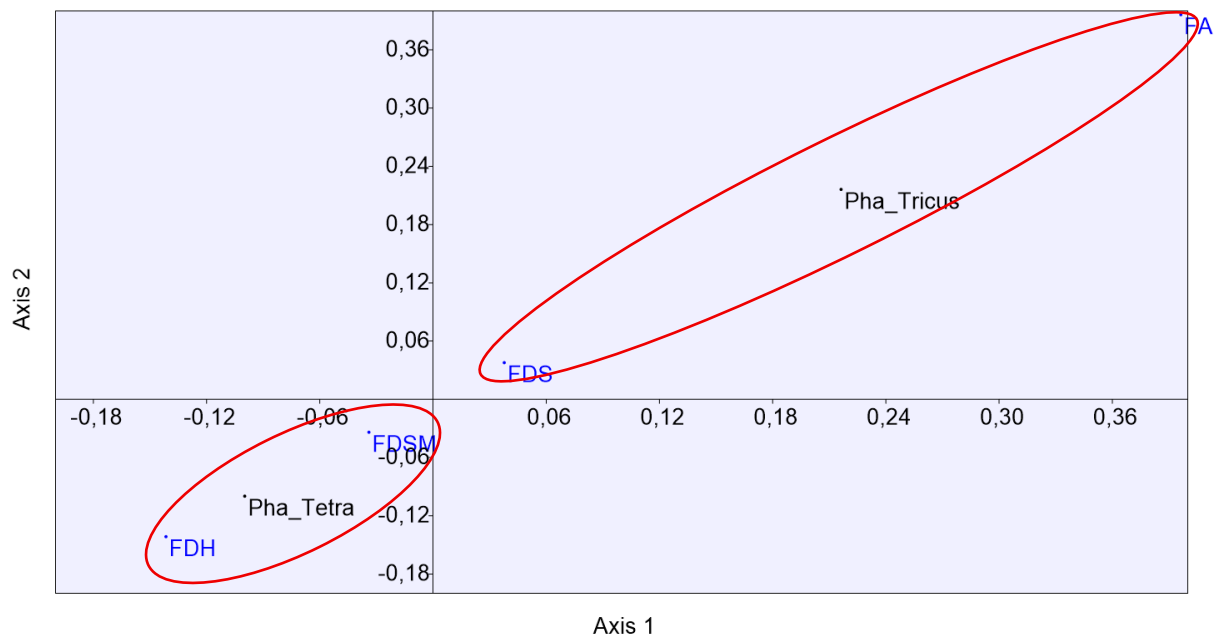
207 **Figure 9.** Distribution of the Pangolin in the classified forest of Goulaleu according to
 208 habitats, Côte d'Ivoire

209

210 ✓ **Daapleu Community Forest**

211 Regarding the Daapleu community forest, the pangolin's habitat distribution differs
 212 from that of the Krozialé and Goulaleu classified forests. In the Daapleu community
 213 forest, the species *Phataginus tricuspis* is observed in both the Dry Dense Forest
 214 (DDF) and Anthropogenic Forest (AF) habitats. Its observation frequency is identical
 215 in these two habitat types. *Phataginus tetradactyla*, on the other hand, is observed in
 216 the Mountain Dense Forest (MDDF) and Humid Dense Forest (HDF) habitats.

217 However, this mammal is more frequently observed in the Humid Dense Forest
218 (HDF) habitat of the Daapleu community forest (Figure 10).



219

220 **FDH** = Dense Humid Forest; **FDSM** = Dense Mountain Forest; **FDS** = Dense Dry Forest; **FA** =
221 Anthropogenic Forest; **Pha_Tricus** = Phataginus tricuspis; **Pha_Tetra** = Phataginus tetradactyla
222

223 **Figure 10.** Distribution of the Pangolin in the Daapleu community forest according to
224 habitats, Côte d'Ivoire

225 **Human-induced threats to pangolin conservation in the studied forests**

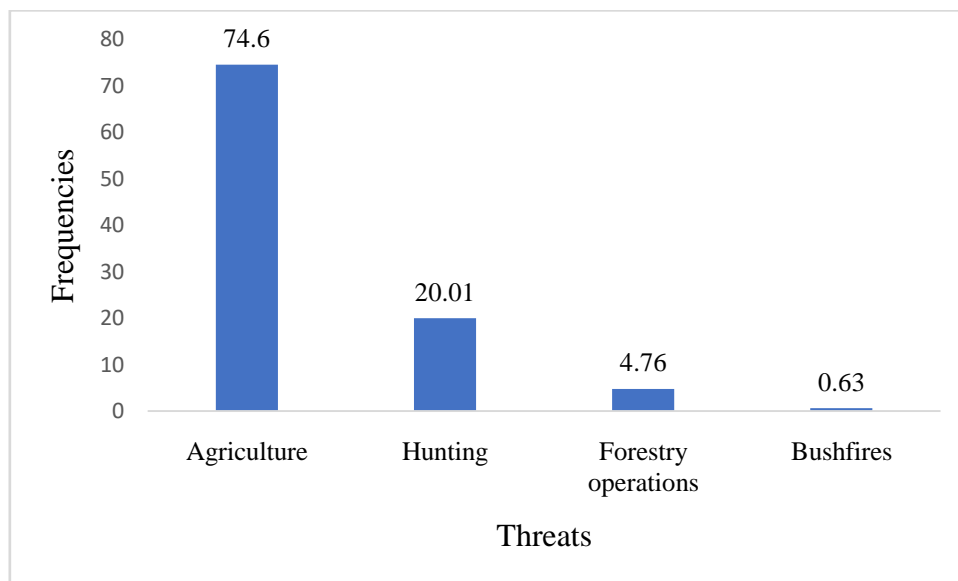
226 The threats to the sustainable conservation of the pangolin in the Krozialé and
227 Goulaleu classified forests and the Daapleu community forest are anthropogenic.
228 These include agriculture, hunting, logging, and bushfires (Figure 11), (Figure 12),
229 and (Figure 13).

230 In the three forests studied, agriculture is the primary threat to pangolin species. Its
231 frequency varies according to the forest studied: Krozialé classified forest (74.60%; N
232 = 235), Goulaleu classified forest (60.63%; N = 134), and Daapleu community forest
233 (60.34%; N = 73).

234 Hunting is the second most significant threat after agriculture. Hunting rates in the
235 Krozialé classified forest were 20.01% (N = 63) compared to 26.70% (N = 59) in the
236 Goulaleu classified forest. Hunting rates were 21.48% (N = 26) in the Daapleu
237 community forest (Figure 14).

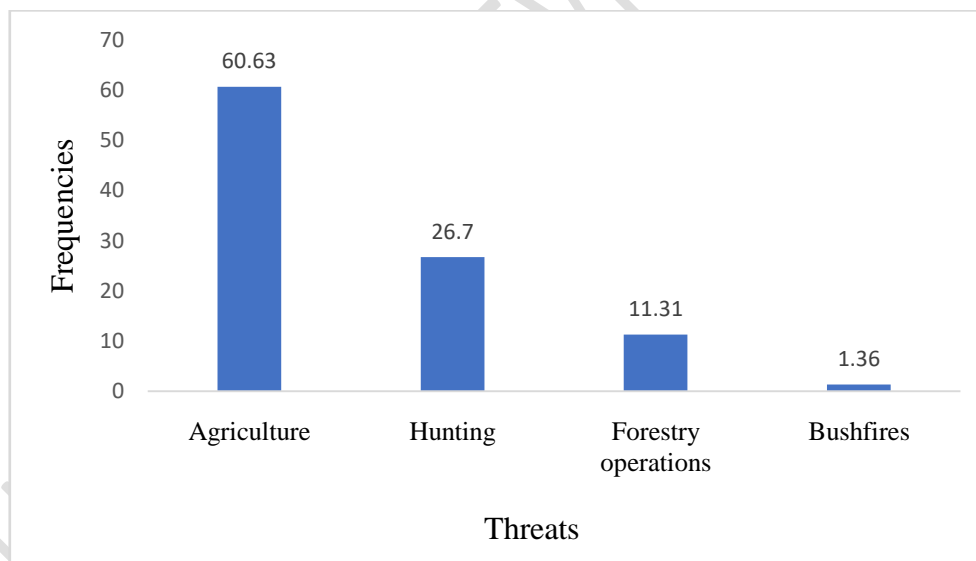
238 Logging poses a threat to pangolin species in the studied forests. Its frequency was
239 14.05% (N = 17) in the Daapleu community forest, 11.31% (N = 25) in the Goulaleu
240 classified forest, and 4.76% (N = 15) in the Krozialé classified forest.

241 Bushfires were rarely observed. Their frequencies are 4.13% (N = 5) in the Daapleu
242 community forest, 1.36% (N = 3) in the Goulaleu classified forest and 0.63% (N = 2)
243 in the Krozialé classified forest.



244

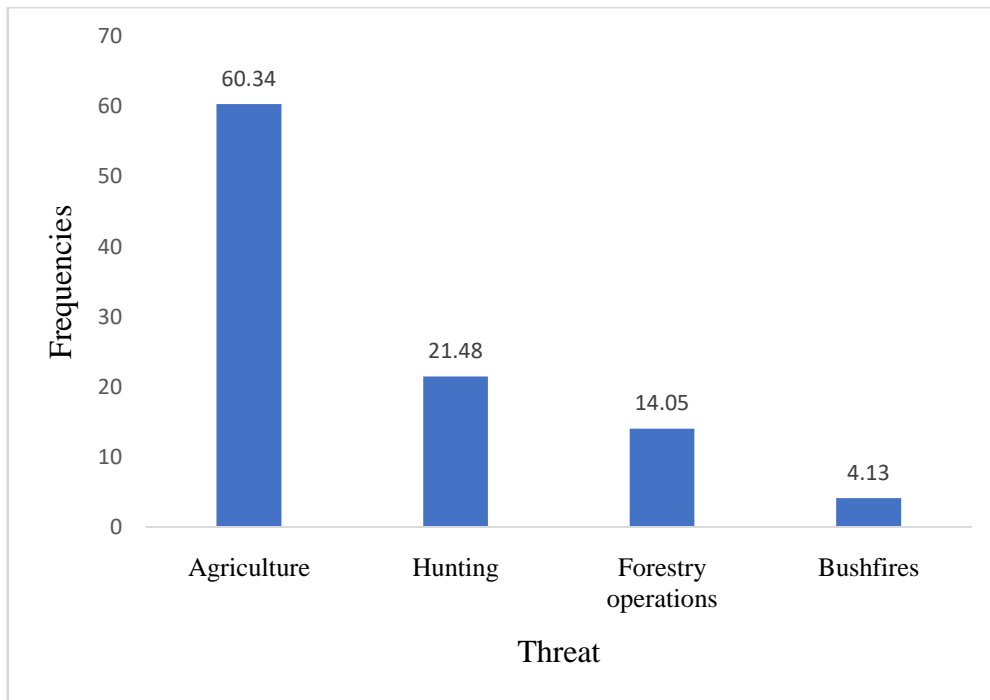
245 **Figure11.**Threats to the sustainable conservation of the Pangolin in the Krozialé
246 classified forest, Côte d'Ivoire



247

248 **Figure12.**Threats to the sustainable conservation of the Pangolin in the Goulaleu
249 classified forest, Côte d'Ivoire

250



251

252 **Figure 13.** Threats to the sustainable conservation of the pangolin in the Daapleu
 253 community forest, Côte d'Ivoire

254



Phataginus tricuspis

Phataginus tetradactyla

255

256 **Figure 14.** Illustration of the threat of hunting to the sustainable conservation of the
 257 Pangolin in the classified forests of Krozialé, Goulaleu and the Daapleu community
 258 forest, Côte d'Ivoire

259 **5. DISCUSSION**

260 A total of 89 pangolin presence indicators were recorded across the three forests. Of these,
 261 70 were indirect and 19 were direct. Visual sightings, feeding sites, and burrows were
 262 more frequently recorded in the Krozialé Classified Forest. The higher number of presence

263 indicators in this forest is likely due to its larger size compared to the Goulaleu Classified
264 Forest and the Daapleu Community Forest. This could also be explained by the fact that
265 the Krozialé Classified Forest provides habitats and food sources essential for the
266 sustainable conservation of wildlife. Indeed, the pangolin is a mammal species that is not
267 restricted to all habitat types (Bhandari et al., 2014; Chao et al., 2020). The presence of
268 pangolins in the Daapleu community forest proves that these types of forest relicts play an
269 important role in the sustainable conservation of endangered species like the pangolin in
270 Côte d'Ivoire and West Africa (Dupuy, 1968; Doran et al., 1973).

271 In the Krozialé classified forest, data collection showed that *Phataginus tetradactyla* and
272 *Phataginus tricuspis* are found more in the eastern part of the forest. This can be explained
273 by the presence of the Cavally River along the entire eastern side of the Krozialé classified
274 forest. This waterway provides characteristic habitats for the pangolin's survival. Indeed,
275 water is a vital resource for animal species, including the pangolin (Emry, 1970). Within
276 the Goulaleu classified forest, both pangolin species are found more in the western part of
277 the forest. This area of the forest consists of plateaus that are difficult for humans to
278 traverse. The pangolins have therefore retreated to these areas to escape potential hunting.
279 This distribution pattern of pangolins in the Goulaleu classified forest has also been
280 observed in the Daapleu community forest, where pangolins are only found in
281 closed canopies. Dense Mountain Forests (DMFs) would thus be the ideal habitat for
282 pangolins, allowing them to escape human activities, including hunting (Chao et al.,
283 2020).

284

285. CONCLUSION

286 In the Krozialé classified forest, the species *Phataginus tetradactyla* is found in the east,
287 south, and west of the forest. *Phataginus tricuspis* is found in the east, south, central, and
288 western parts of the forest. In the Goulaleu classified forest, *Phataginus tetradactyla* is
289 found in the north and west of the forest. *Phataginus tricuspis* is found in the north, west,
290 and south of the forest. In the Daapleu community forest, *Phataginus tetradactyla* is found
291 in the northeast, east, and southwest of the forest. *Phataginus tricuspis* is found only in the
292 northern part of the forest.

293

294 During our study in the Krozialé and Goulaleu classified forests, and later in the Daapleu
295 community forest, four different habitat types were identified: Dense Humid Forest
296 (DHF), Dense Mountain Forest (DMF), Dense Dry Forest (DDF), and Anthropogenic
297 Forest (AF). The majority of pangolin individuals were identified in the Dense Mountain
298 Forest (DMF) habitat.

299 The threats to the sustainable conservation of pangolins in the Krozialé and Goulaleu
300 classified forests and in the Daapleu community forest, in order of frequency, are
301 agriculture, hunting, logging, and bushfires.

307. ACKNOWLEDGEMENT

303 We would like to thank Commander LOBA Don Alexandre and Captain EBE Yao Bertin
304 for providing us with a map of the classified forests of Krozialé and Goulaleu, which
305 facilitated our fieldwork during village surveys. We also extend our thanks to the youth
306 leaders of Daapleu, Mr. Ghislin Memen and Mr. Diaglo Kamin, for their invaluable
307 collaboration at the study sites.

308. CONFLITS D'INTERETS

309 The authors declare that there is no conflict of interest for this article.

310. CONTRIBUTION DES AUTEURS

311 Kramoko BAMBA collected the data, Kramoko BAMBA and Koffi Jules GOSSÉ
312 performed the data processing, statistical analysis, and manuscript writing. The other co-
313 authors contributed to proofreading and improving the article.

3140. REFERENCES

315 Archer, E., Dziba, L. E., Mulongoy, K. J., Maoela, M. A., Walters, M., Biggs, R., Salem,
316 M.-C. C., DeClerck, F., Diaw, M. C., Dunham, A. E., Failler, P., Gordon, C., Harhash, K.
317 A., Kasisi, R., Kizito, F., Nyingi, W. D., Oguge, N., Osman-Elasha, B., Stringer, L. C., ...
318 Sitas, N. (2021). Biodiversity and ecosystem services on the African continent – What is
319 changing, and what are our options? *Environmental Development*, 37, 100558.
320 <https://doi.org/10.1016/j.envdev.2020.100558>

321

322 Heinrich, S., Wittman, T. A., Ross, J. V., Shepherd, C. R., Challender, D. W. S., &
323 Cassey, P. (2017). The global trafficking of pangolins: A comprehensive summary of

324 seizures and trafficking routes from 2010–2015. *Southeast Asia Regional Office, Petaling*
325 *Jaya, Selangor, Malaysia, TRAFFIC*, 37

326 Kouassi, J.-L., Diby, L., Konan, D., Kouassi, A., Bene, Y., & Kouamé, C. (2023). Drivers
327 of cocoa agroforestry adoption by smallholder farmers around the Taï National Park in
328 southwestern Côte d'Ivoire. *Scientific Reports*, 13(1), 14309.
329 <https://doi.org/10.1038/s41598-023-41593-5>

330

331 Gaubert, P., Njiokou, F., Ngua, G., Afiademanyo, K., Dufour, S., Malekani, J., Bi, S. G.,
332 Tougard, C., Olayemi, A., Danquah, E., Djagoun, C. A. M. S., Kaleme, P., Mololo, C. N.,
333 Stanley, W., Luo, S.-J., & Antunes, A. (2016). Phylogeography of the heavily poached
334 African common pangolin (Pholidota, *Manis tricuspis*) reveals six cryptic lineages as
335 traceable signatures of pleistocene diversification. *Molecular Ecology*, 25(23), 5975-5993.
336 <https://doi.org/10.1111/mec.13886>

337

338 Challender, D. W. S., Harrop, S. R., & MacMillan, D. C. (2015). Towards informed and
339 multi-faceted wildlife trade interventions. *Global Ecology and Conservation*, 3, 129-148.
340 <https://doi.org/10.1016/j.gecco.2014.11.010>

341

342 Zanvo, S., Djagoun, S. C. A. M., Azihou, F. A., Djossa, B., Sinsin, B., & Gaubert, P.
343 (2021). Ethnozoological and commercial drivers of the pangolin trade in Benin. *Journal of*
344 *Ethnobiology and Ethnomedicine*, 17(1), 18. <https://doi.org/10.1186/s13002-021-00446-z>

345

346 Challender, D., & Waterman, C. (2017). Implementation of CITES Decisions 17.239 B)
347 and 17.240 on Pangolins (*Manis* spp.). *Prepared by IUCN for the CITES Secretariat*.
348 *SC69 Doc*, 57

349

350 Sidibé, O., Kouassi Kouadio, H., Bamba, I., & Kouassi Konan, E. (2020). Political-
351 military crisis and forest fragmentation in the Mont Péko national Park in Côte d'Ivoire.
352 *Cybergeo: European Journal of Geography*. <https://doi.org/10.4000/cybergeo.34842>

353 Gossé, K. J., Gonedélé Bi, S., Dufour, S., Danquah, E., & Gaubert, P. (2023).

354 *Conservation genetics of the white-bellied pangolin in West Africa : A story of lineage*
355 *admixture, declining demography and wide sourcing by urban bushmeat markets* (p.
356 2023.03.09.531886). bioRxiv. <https://doi.org/10.1101/2023.03.09.531886>

357

358 Kadet, B. G. (2015). L'ouest forestier ivoirien : Enjeux et problèmes d'une zone grise. *Les*
359 *Cahiers d'Outre-Mer. Revue de géographie de Bordeaux*, (271), Article 271.

360 <https://doi.org/10.4000/com.7578>

361

362 Bhandari, N. & Chalise, M. K. (2014). Habitat and Distribution of Chinese Pangolin
363 *Manis Pentadactyla* Linnaeus, 1758) in Nagarjun Forest of Shivapuri Nagarjun National
364 Park, Nepal. *Nepalese Journal of Zoology* 2 (1): 15 – 25

365

366 Chao, J. T., Li, H. F. & Lin, C. C. (2020). Chapter 3 – The role of pangolins in
367 ecosystems. In D. W. S. Challender, Nash, H. C. & Waterman, C. (Eds.) *Pangolins:*
368 *Science, Society and Conservation* p: 43 – 48: Academic Press.

369

370 Din Dipita, A., Missoup, A. D., Tindo, M. & Gaubert, P. (2022). DNA-
371 typing improves illegal wildlife trade surveys: Tracing the Cameroon-nian bushmeat trade.
372 *Biol. Conserv.* 269, 109552

373

374 Doran, G. A. & Allbrook, D. B. 1973. The tongue and associated structures in two species
375 of African pangolins, *Manis gigantea*, and *Manis tricuspis*. *Journal of Mammalogy* 54:
376 887-899.

377

378 Dupuy, A. R. 1968. Sur la première capture au Sénégal d'un grand Pangolin
379 *Smutsiagigantea*. *Mammalia* 32: 131-132.

380

381 Emry, R. J. 1970. A North American Oligocene pangolin and other additions to Pholidota.
382 *Bulletin of the American Museum of Natural History* 142 : 459 – 510.

383

384 Hoppe-Dominik, B., Köhl, H.S., Radl G., & Fischer, F. 2011, Long term monitoring of
385 large rainforest mammals in the biosphere reserve of Taï National Park, Côte d'Ivoire.

386 *African Journal of Ecology*, 49 (4), pp. 450-458

387

388Ingram, D. J., Cronin, D. T., Challender, D. W. S., Venditti, D. M. & Gonder, M. K.
389(2019). Characterisingtrafficking and trade of pangolins in the Gulf of Guinea. *Glob. Ecol.*
390*Conserv.* **17**, e00576

391Kadjo B., Azani D., Tsague L., &Gomse A., (2014). Etat des lieux des populations
392d'Hippopotames et autres grands mammifères du Parc National de la Marahoué (Côte
393d'Ivoire). *Agronomie Africaine*, 26 (2) : 89-101

394

395Morton, O., Scheffers, B. R., Haugeaasen, T. & Edwards, D. P(2021). Impacts of
396wildlifetrade on terrestrial biodiversity. *Nat. Ecol. Evol.* **5**, 540–548

397

398Walsh, P. D., & White, L.J.T. 1999, What It Will Take to Monitor Forest Elephant
399Populations. *Conservation Biology* **13**, pp. 1194-1202

400

UNDER PEER REVIEW IN IJAR