

# Opinions, attitudes and perceptions of local people towards the conservation of Nigeria-Cameroon chimpanzees in Mpem-Djim National Park, central Cameroon

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## Abstract

1. Local ecological knowledge (LEK), tied to specific cultures, is crucial for sustainability in conservation initiatives. Therefore, including holders of this knowledge in management decisions is essential. Collecting protected area-specific data on local people's attitudes, opinions and perceptions towards wildlife, especially for highly threatened species like great apes, is therefore crucial for effective conservation. This study emphasizes the importance of LEK as an interdisciplinary approach, highlighting its essential role in informing conservation decisions and understanding human–environment interactions.
2. To fill the information gap on the LEK on the Nigeria-Cameroon chimpanzee in central Cameroon, we used questionnaires to assess the LEK of respondents specifically their perceptions, opinions and attitudes towards the population trend of chimpanzees, as well as their opinion about the current management systems of Mpem and Djim National Park. We collect data from 240 respondents in 15 villages in the neighbourhood of the park. Using generalized linear mixed models, we were also able to assess socioeconomic and demographic factors that correlate with the opinions, attitudes and perceptions of the respondents towards chimpanzee conservation.
3. About 87% of the respondents exhibited good knowledge about chimpanzees and 59% reported taboos related to chimpanzees. About 94% were aware of laws that prohibit the hunting of chimpanzees, while 87% agreed that it is a good initiative to conserve chimpanzees, and 42% reported that their population increased. Almost half (52%) of the respondents said they were satisfied with the current park management system. Age, gender, education level, number of children in the household and time spent in the community were predictors that influenced the attitude, opinion and perception of the respondents while occupation and the geographic distance between the village and the park did not.
4. Our findings suggest that raising awareness of human–chimpanzee coexistence through adult education programmes should target specific demographic groups,

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such as those with larger families, limited education, older age, individuals with lower LEK or native. These findings brought insights to guide future studies and should be taken into account when discussing regional management.

#### KEYWORDS

attitude, chimpanzee conservation, generalized linear mixed models, local ecological knowledge, opinion and perception

## 1 | INTRODUCTION

The production and consumption needs of an increasing human population have put enormous pressure on natural habitats including tropical rainforests (Brockington & Duffy, 2010). Africa is particularly affected by the ongoing biodiversity decline caused by swift environmental transformations. Natural resources serve as a crucial tool for socioeconomic advancement and are the primary means of support for a growing human population (Achieng et al., 2023). Among the rainforest species threatened with extinction are primates, especially great apes. Their numbers have been severely decreased for several decades (Fernández et al., 2022). Apes are particularly vulnerable since roughly one-quarter of their populations lives outside of protected areas (Hockings & Humle, 2009). The Nigeria-Cameroon chimpanzee (*Pan troglodytes ellioti* Matschie, 1914, hereafter chimpanzee) is especially affected and is listed as endangered by IUCN (Oates et al., 2016). Climate change, habitat destruction, illegal poaching, species trafficking and several infectious diseases threaten its population (Fotang et al., 2021; Sesink Cleo et al., 2015). Populations is declining throughout their natural range. Currently, the global population comprises only 3500 to 9000 individuals (Abwe, 2018; Morgan et al., 2011). In general, chimpanzees can play an important role (as seed dispersers, pollinators and in predator-prey relationships) as the flagship or umbrella species for conservation (Sun et al., 2022).

In central Cameroon, *Pan troglodytes ellioti* occurs in two genetically differentiated populations; one population in the western rainforest and the second in the central Cameroonian forest-woodland-savanna ecotone (Abwe et al., 2019; Mitchell et al., 2015). The ecotone population is present in two national parks, Mbam-Djerem National Park (Kamgang et al., 2018) and Mpem and Djim National Park (MNDP; Ernest Fotsing, unpublished data). In both parks, the habitat is characterized by a forest-savanna mosaic. Due to the high risks of extinction, a regional action plan (RAP) was established for the chimpanzees with a recommendation to determine their distribution, abundance and potential priority conservation sites (Morgan et al., 2011). Recently, a species distribution modelling was carried out to localize the distribution of suitable habitat for the chimpanzees in Cameroon (Fotang et al., 2023).

Low and Heinen (1993) predicted successful conservation programmes based on human resource use behaviour. In fact, sustainable conservation of natural resources is more successful if

local people are involved and if local ecological knowledge (LEK) is embedded in conservation plans and actions (Benyei et al., 2020; Malmer et al., 2020; Zhang et al., 2020). Local knowledge or LEK is defined as the knowledge used by local people to make a living in a particular environment (Warburton & Martin, 1999; Warren, 1993). This is a body of knowledge built up by a group of people through generations of living in close contact with nature and is unique to a given culture or society (Johnson, 1992; Warren, 1989).

Local ecological knowledge has made various contributions to biodiversity research and management (Machlis, 1992) The importance of recognizing LEK systems emerged in 1987 from the report on sustainable development by the World Commission on Environment and Development (WCED) which highlights people living in the vicinity of potential conservation sites as important stakeholders in preserving wildlife (Mehta & Kellert, 1998). Due to their proximity with natural habitat (Kusi et al., 2020), local people may have strong LEK about their ecosystem (Brasileiro et al., 2011; Simo et al., 2020). According to some studies, LEK can be a source of valuable biological information on species abundance, population trends and human-wildlife conflicts (Casanova et al., 2014; Fopa et al., 2020; Gebo et al., 2022; Kamgang et al., 2021; Teixeira et al., 2021; Zayonc & Coomes, 2022). Furthermore, by providing information on nocturnal, elusive or data-deficient species and threats (Marneweck et al., 2021; Mouafo et al., 2021), LEK can inform management activities (Cortés-Avizanda et al., 2018). LEK, like other forms of citizen science diverges from formal scientific approaches by integrating the daily experiences of local communities in their ecosystems. Unlike standardized methodologies (e.g. line transects, camera trapping, etc.), which also inform conservation decision, LEK incorporates spiritual, cultural and social dimensions (Senanayake, 2006).

Typical top-down management of protected areas has marginalized the benefits to local people and paid little attention to the role of local participation in protected area planning and decision-making (Miao, 2000). However, it has been recognized that many demographic factors such as age, education, location, wealth and ethnicity can significantly shape the attitudes, perception or opinion of local people (Gillingham & Lee, 1999; Mehta & Heinen, 2001) towards wildlife. Attitude here is defined as the mechanism that allows people to make better judgements (Costa, 2010), while opinion is expressed as a declaration of judgement (Price, 1992). Perception, on the contrary, is how something is regarded, understood or interpreted (Bennett, 2016). From the above definition, it appears that

direct contact with wild animals can influence the perception of wildlife (Basak et al., 2022). Seeing a species more often can have a positive effect on people's opinion (Liordos et al., 2020) but if people see dangerous carnivores or animals destroying their crops, people will perhaps develop a more negative perception (Johansson et al., 2021). For example, Mehta and Kellert 1998 show that respondents in Nepal had negative perceptions of community development programmes, while Dickman (2010), Chuo and Angwafo (2017) and Kamgang et al. (2021) found that these perceptions were mainly influenced by social or cultural normative beliefs, education, main livelihood activity and religious beliefs. Yang et al. (2015) also found that the majority of respondents were disappointed with the management of the Bulong Nature Reserve (BNR). People's attitudes and beliefs towards wildlife can also be affected by demographic factors, such as age, gender, household size (Gebo et al., 2022; Mendako et al., 2022; Penjor et al., 2021), the size of the land (Xu et al., 2006) or by other socioeconomic factors such as the main source of income and the number of livestock in the household (Biset et al., 2019; Gebresenbet et al., 2018). The neglect of the above research topics would result in ignorance of the human dimension in MNDP management. Analysing sociodemographic factors impacting resident's LEK and attitude can therefore help to identify key individuals interested in contributing to future conservation efforts in the area. Following the RAP recommendations, several studies related to human–chimpanzee coexistence have been carried out focused on the rainforest chimpanzee population (Chuo & Angwafo, 2017; Kamgang et al., 2021; Njukang et al., 2019). Similar studies are missing for the ecotone population, particularly for the MNDP. Given the value of LEK in developing and implementing conservation strategies on the one hand, and the lack of information on LEK for ecotone chimpanzees on the other hand, the overarching goal of this study was to develop a better understanding of residents' perceptions, opinions and attitudes towards the chimpanzee population and a corresponding conservation initiative.

In our interview survey, we had three distinct objectives: (1) We assessed the current knowledge of local people about chimpanzees and their conservation. (2) We analysed the relationships between demographic and socioeconomic factors and local people's perceptions opinions, and attitudes towards chimpanzee conservation, and we assessed the magnitude of human–wildlife conflict. (3) We evaluated how the local people perceive the current management system implemented by the government in MNDP. As in similar previous studies (Gebo et al., 2022; Mendako et al., 2022; Penjor et al., 2021), we predicted that age, gender, household size, level of education of interviewees and distance between their place of residence and the park would be positively related to respondents perceptions, attitudes and opinions with males showing higher LEK than females. We also predict that most of the respondents will not have strong LEK about chimpanzees and will be very disappointed with the current MNDP management system. The results of our study will close the gap of LEK data deficit towards chimpanzees in MNDP. This information can be used to improve the coexistence between chimpanzees and humans and future conservation actions in MNDP.

## 2 | METHODS

### 2.1 | Study area

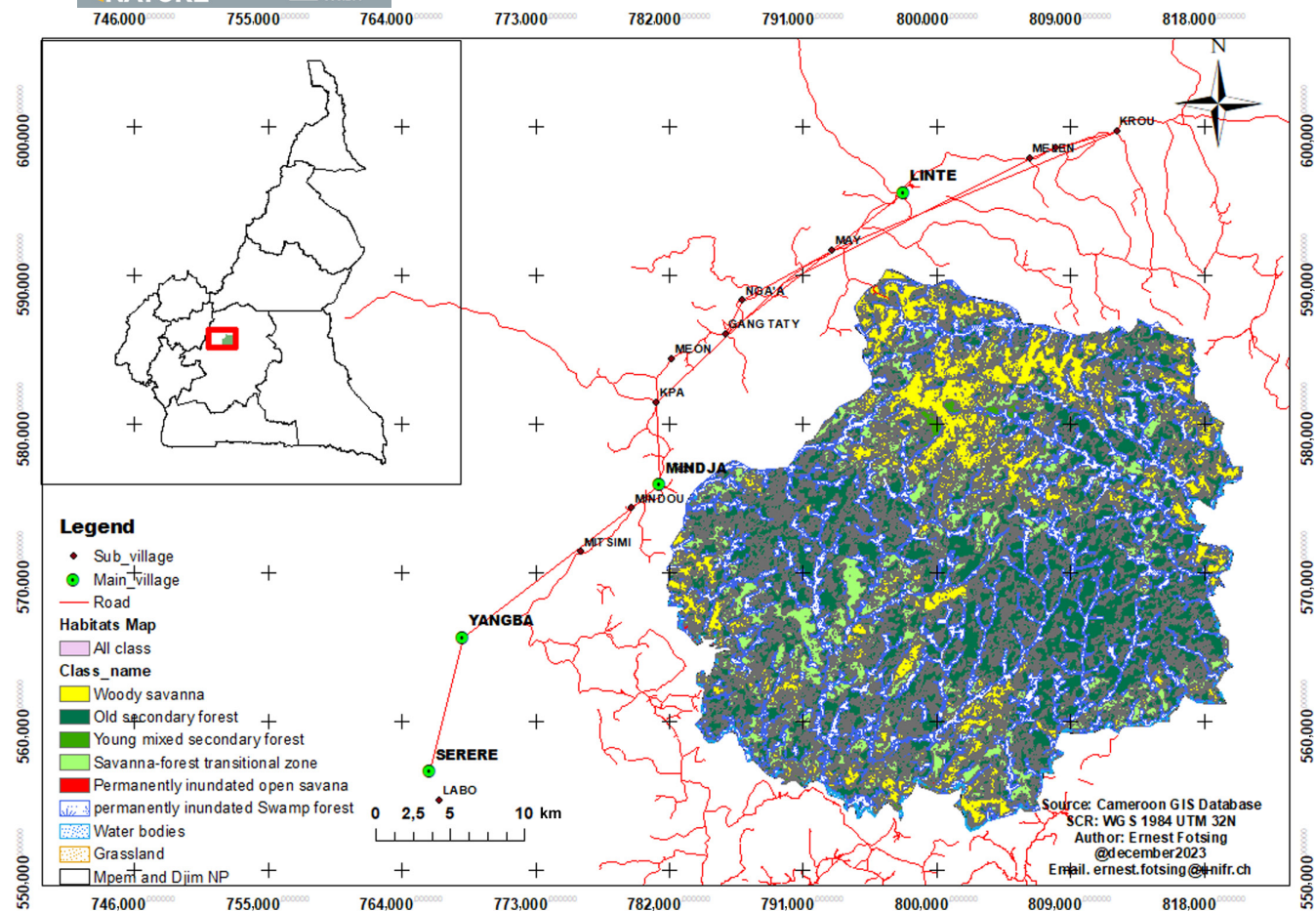
This study was carried out in the Mpem and Djim National Park (MNDP) in the Centre Region of Cameroon (Ntui Division) (Figure 1). The MNDP was established on 12 May 2004, by the Government of the Republic of Cameroon (Law No. 2004/0886/PM). The size of the park is 974.8 km<sup>2</sup>, with an average altitude of 640 m (Simo et al., 2023). The park is located in the transition zone between the forest and the savanna mosaic and has a high degree of plant and animal diversity (Atagana et al., 2018; Bitja, 2018; Bitja et al., 2021; Donfack, 2021; Fopa et al., 2020; Simo et al., 2019, 2021), including the chimpanzee (Ernest Fotsing, unpublished data). The site has an annual minimum and maximum temperature of 22.9°C and 29.1°C, respectively, and a subtropical rainfall pattern (four seasons) characterized by an annual average of 1500 mm (Santoir & Bodba, 1995). People of different ethnic groups (also called tribes) and faiths (Christians, Muslims and Animists) inhabit the villages near the park (Fopa et al., 2020; Kirsten et al., 2019; Nzie, 2021). Each ethnic group has a specific local dialect and tradition (Nzie, 2021), although French is the main language spoken in the area. Regardless of their ethnic and religious affiliation, the main source of income is subsistence agriculture and livestock farming. (Kirsten et al., 2019). Therefore, similarities and differences among locals may affect attitudes and perceptions towards chimpanzees and their conservation in MNDP.

### 2.2 | Selection of villages for surveying

Besides the general similarity among the settlements near the park in terms of their main source of income (agriculture and livestock farming) and the fact that they are all linked by the same road network as you can see in Figure 1, they also showed some differences in population size, proximity to the park, state of infrastructure (villages with and without water points) and their dependence on natural resources that come directly from the park. Since it was not possible to survey all villages and hamlets (also called subvillages) around the park, we selected 15 villages (Figure 1, four main villages and 11 hamlets) that represent the diversity of villages well. Our selection was based on information drawn from previous reports (Kirsten et al., 2019; Nzie, 2020, 2021) and on the year-long work experience in the region of one of us (EDBF).

### 2.3 | Interviews

Interviews are a useful and widely used method for gathering information to understand the perspectives of people on wildlife and conservation (Rutina et al., 2017; Western et al., 2019). Our survey instrument was a questionnaire. The questionnaire (Supplementary Material 1) was prepared in advance following the recommendations of some authors (Nash et al., 2016; White et al., 2005). The



**FIGURE 1** Locations of the park in the central region of Cameroon (top left) and the villages surveyed around it. The colour of the village symbol indicates the main village (green circle) and the hamlets (purple rhombuses) where the people were interviewed.

questionnaire included open and closed questions, which we developed by combining and improving the method already used in previous studies (Gataro & Tekalign, 2021; Mendako et al., 2022; Ulimboka et al., 2022).

## 2.4 | Pilot survey

We conducted a pilot survey in the last week of July 2021 in Linte village (Figure 1) to: (a) ensure that all questions were clear to household members; (b) train interviewers, and (c) improve the questionnaire sheet and to standardize how it will be filled. We randomly selected 20 households and interviewed 20 people (12 men and 8 women) of different ages, gender, educational status, main sources of income and number of children, and finally reviewed the questionnaire for actual data collection.

## 2.5 | Questionnaire survey

We interviewed people in different villages between August 4 and 30, 2021. We established four interview teams each with an

experienced interviewer (including EDBF) and one local guide who was recruited to accompany the interviewer in the respective village and to assist with translation from French to the local language when necessary (Newing et al., 2010). Each interview took around 45–60 min per respondent. The interviews were conducted as proactive conversations during direct door-to-door visits. In each village, a household was considered a sampling unit. The questionnaire was administered to both the head of the household (usually the man) and his wife. If the couple was present at the same time, they both received the questionnaire but in different rooms by two interviewers. If only one partner was present, the interviewers interviewed only this one. A woman was considered the head of the household when her husband was absent. In case, both partners were absent, the interviewers interviewed the available person (in this case considered as the head of household), which can be any person living in the same household older than 15 years, who was born in the village and had lived there for at least 10 consecutive years.

The questionnaire addressed to the respondents was divided into five main topics. (1) We asked for demographic information (later used as predictors in the modelling process, that is gender, age, number of children, distance from the village to the park, level of education, time spent in the community, ethnic group and main



occupation). (2a) We asked about knowledge about chimpanzees. Can the interviewee correctly identify and name the chimpanzees from images of five species captured in MNDP during our camera trap survey? as a control species, we also added a picture of a gorilla (Rutina et al., 2017) which is not present in the site. (2b) We asked for chimpanzee sightings. (2c) We asked about the perception of the trend of the chimpanzee population. (2d) We asked about the potential cultural importance of chimpanzees or whether the interviewee believes that taboos (social rules) exist that prohibit the consumption of chimpanzee meat (Landim et al., 2023). (2e) We asked for the use of chimpanzee in traditional medicine. (2f) We asked for hunting and eating practices. (3) We asked for the main source of income and potential conflicts with wildlife, including chimpanzees. (4) We asked for knowledge of laws regarding the conservation of chimpanzee in Cameroon. (5) We asked the respondent's opinion on the current management systems of the park by the government.

### 2.5.1 | Ethics

Our study followed the laws and permits that govern scientific research in the Republic of Cameroon. We obtained research authorization NO 0000043 and research permit NO 02048 from both the Ministry of Scientific Research (MINRESI) and the Ministry of Forestry and Wildlife (MINFOF) of the Republic of Cameroon. This research was also conducted following the principles of the American Society of Primatologists and the International Society of Ethnobiology (ISE) Code of Ethics (ISE, 2006) for the ethical treatment of nonhuman and human primates. Authorization from local chiefs and consent (verbal and written) of the respondents were obtained before interviewing them, and they were also informed of the confidentiality of their responses and the fact that they could leave the interview at any time (Akrim et al., 2017).

## 2.6 | Data analysis

### 2.6.1 | Data fusion

As the number of respondents in some hamlets was very low (sometimes less than 10 which for the majority of hamlets were due to the number of people living there), we decided to merge the data from each hamlet with its corresponding main village. This was done after a discussion with the chief of each main village. It was the responsibility of each chief to confirm which of the hamlets were under his authority so that the data could be merged accordingly. Therefore, our data analysis was carried out based on the four main villages (Linte, Mindja, Yangba and Serrere). To ensure adequate sample size and interpretability, we grouped the educational level of the respondents into five categories: (1) no education, (2) maternal education, (3) primary education, (4) secondary education and (5) higher education (referred to

as university). For age, based on respondents physical ability to move in the forest, we defined five classes but three categories: (1) young adult (15–24 and 25–35 years), (2) medium adult (36–45 and 46–55 years) and (3) older adult (>56 years). We also grouped all chimpanzee observation responses made before 2016 into a unique response category called 'before 2016'.

### 2.6.2 | Analyses

For a preliminary univariate analysis, we used IBM SPSS 2021 (IBM, 2021) to perform descriptive statistics and chi-square tests to compare the percentages of different response variables obtained. Subsequently, we explored how socioeconomic characteristics correlate with participants' opinions, perceptions and attitudes using a logistic regression method. We performed generalized linear mixed models (GLMM) in R version 4.2.3 (R Core Team, 2022). The description of all models including the response variables and predictors used to fit each model is given in Supplementary Files 2a and 2b.

#### *Binomial models*

As described in Supplementary Files 2a and 2b, we fitted 10 binomial models (BM) with 10 different response variables obtained from yes or no answers in the questionnaires. In these models, we used three continuous variables (time spent in the community, geographic distance from the village of the respondent to the park, and number of children in the household) and four categorical variables (age, gender, education level and main occupation) as independent variables. BM models were fitted with binomial error structure and logit link function described as follows:  $\text{Logit}(\pi_{ij}) = \beta_0 + \beta_1 x_{ij} + \dots + \beta_p x_{ij} + \epsilon_{ij}$  where  $\text{logit}()$  is the logit function;  $\pi_{ij}$  represents the probability of success for the  $i$ th observation in the  $j$ th group;  $x_{ij}$  are the predictor variables (also called fixed effects) associated with the  $i$ th observation in the  $j$ -th group;  $\beta_0$  (intercept),  $\beta_1, \dots, \beta_p$  are the corresponding coefficients for the fixed effects and  $\epsilon_{ij}$  is the error term, representing the unexplained variability within each group (McCullagh & Nelder, 1989).

#### *Ordinal models*

As described in Supplementary Files 2a and 2b, we used five categorical variables (age, gender, education level, last year of chimpanzee sighting and main occupation) and one continuous variable (geographic distance from respondent village to park) as independent variables to perform four ordinal models (OM) with four different ordered response variables of our questionnaires. For these ordinal models, we used the cumulative logit mixed link (Agresti, 2007) described as follows:  $\text{Logit}[P(Y \leq j|x)] = \alpha_j + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p$ . This represents the cumulative probability that the ordinal response variable  $Y$  is less than or equal to category  $j$ , given the values of the predictor variables  $x$  (i.e.  $P(\text{Attitudes} \leq j|x)$ ); where  $\alpha_j$  is the intercept term specific to the  $j$ th category of the ordinal response variable;  $x_1, x_2, \dots, x_p$  are the predictor variables  $p$  and  $\beta_1 + \beta_2 + \dots + \beta_p$  are the

corresponding coefficients for the predictor variables (Winship & Mare, 1984).

For BM and OM, we used ethnic groups as a random intercept effect. All models included all theoretically identifiable random slopes (Schielzeth & Forstmeier, 2009) to avoid an overconfident model and to keep the type I error at the nominal level of 0.05. We did not include parameters for the correlations between random intercepts and slopes, as these usually proved to be unidentifiable (as indicated by absolute correlation parameters close to 1, Matuschek et al., 2017) or because their inclusion led to convergence problems (OM). To avoid cryptic multiple testing (Forstmeier & Schielzeth, 2011), we used chi-square tests to compare each full model with a corresponding null model that omitted all fixed-effects predictors but was otherwise identical to the corresponding full model. To assess the goodness-of-fit of each model (which allows to validate the reliability of the model results), the Pearson chi-square test was used to quantify the discrepancy between the observed and expected outcomes predicted by each model (Hosmer & Lemeshow, 1980). The obtained *p*-values were compared again with a number between 0 and 1 with higher values (*p* close to 1), indicating a better fit while a *p*-value below a specified  $\alpha$  level of 0.05 indicates that the model is not acceptable (Alison, 2014).

For all models, the factor predictors were dummy-coded. Age, gender, main occupation and level of education were dummy coded, with the age group [15–24], gender [female], occupation [farmer] and no education being the reference category for our continuous variables. These models were all fitted in R (version 4.2.3) using the *glmer* function of the *lme4* package for binomial models (Bates et al., 2015) and the *clmm* function of the *ordinal* package (versions 2019.12-10) for ordinal models (Christensen., 2019). Before model fitting, all quantitative predictors were z-transformed to a mean of zero and a standard deviation of one to facilitate model convergence. The stability of each model was determined by dropping random effects levels one at a time and comparing the estimates obtained when fitting the full model to the respective subsets with those obtained for the full data set. We obtained 95% confidence intervals (CI) for model estimates and fitted values using a parametric bootstrap ( $N=1000$  bootstraps). For BM, we obtain CIs using the *bootMer* function of the package *lme4* (versions 1.1–29) (Bates et al., 2015) but, for OM, we obtain CIs with a function written by Roger Mundry (this function performs bootstrap ( $N=1000$ ) to obtain CIs of the model parameters).

To assess the level of collinearity between predictors, the generalized variance inflation factor (VIF; Field, 2005) was determined for each model through the *vif* function of the package *car* (version 3.0–13; Fox & Weisberg, 2019). A preselected threshold value of 3 was chosen to determine the multicollinearity between predictor variables (Zuur et al., 2010). For each model, all parameters (coefficient, B), standard error (SE), *p*-value (sig), odds ratio which is  $\text{Exp}(B)$  and confidence interval (CI) were obtained, and the significant predictor for each model presented in Table 1. A summary of all significant predictor variables is also presented in Supplemental File 3.

## 3 | RESULTS

### 3.1 | Socioeconomic background and demographic characteristics of the respondents

We interviewed 240 people (in 200 households) but not all respondents answered all the questions, so the number of respondents (*N*) may differ from question to question. The interviewees belonged to 15 ethnic groups/tribes (EG) within the four main villages (and adjunct hamlets). Baboute (34.2%,  $N=82$ ) and Vute (30.8%,  $N=74$ ) were the dominant EGs, with 13 other minority EGs representing 34.97% ( $N=84$ ).

In general, 49.2% ( $N=118$ ) of the respondents were from Linte, 23.3% ( $N=56$ ), 15.4% ( $N=37$ ) and 12.1% ( $N=29$ ) were from Yangba, Serere and Mindja, respectively. 75% ( $N=181$ ) of the respondents were male and 25% ( $N=59$ ) were female. The age ranged from 16 to 70 years (mean = 39.1,  $SD=11.7$ ) and their distribution was as follows: young adults 38.8% ( $N=93$ ), medium adults 52.5% ( $N=126$ ) and older adults 8.8% ( $N=21$ ). The number of children per household ranged from 0 to 12 (mean = 4.1,  $SD=3.0$ ,  $N=240$ ).

A relatively large group had no education (12.1%,  $N=29$ ), and few respondents 1.3% ( $N=3$ ) had only maternal education. Most of the interviewees (56.7%,  $N=124$ ) had at least primary and 33.3% ( $N=80$ ) also secondary education. Only 1.7% ( $N=3$ ) had attended university. The main income of the respondents was agriculture (88.8%,  $N=213$ ), followed by hunting (8.3%,  $N=20$ ), trade (2.1%,  $N=5$ ) and fishing (0.9%,  $N=2$ ). Most of the respondents (77.9%,  $N=187$ ) owned livestock (chicken 60%, goats 25%, pigs 10%, cattle and sheep 5%). The average time spent in the community of the interviewees was 39 years and most (53.8%,  $N=129$ ) of them had spent at least 21 years in the community (most of them reported being born there). Table S1 in Supplementary Material 4 provides a summary of the demographics of the respondents in the villages around Mpem and Djim National Park, Cameroon.

### 3.2 | Local knowledge of chimpanzee

Overall, 86.6% ( $N=207$ ) of the respondents gave correct answers to all the questions about chimpanzees (respondents generally recognized and correctly named chimpanzees providing accurate information about the species, including colour, morphology, feeding habits and resemblance to humans), while 12.1% ( $N=29$ ) were unable to do so and 1.3% ( $N=3$ ) did not respond. Of those who responded, 70.2% ( $N=145$ ) had seen chimpanzees, while 29.8% ( $N=62$ ) had not. The number of respondents who had seen chimpanzees varied strongly between the villages (Figure 2a), gender (Figure 2b) and age (Figure 2c). Also, most chimpanzee sightings have been some years ago with a large proportion of sightings made before 2016 (Figure 2d). Most (92.0%) stated that they had seen chimpanzees in the forest, 7.0% had seen them in the savanna, while one person (1.0%) told us that he had seen the species in the village. This person explained: 'The chimpanzee was killed by a friend on the orders of a trafficker'.

TABLE 1 Summary of models 1–8.

Model type											
Binomial logistic regression	Model 1 (chimpanzee sighting)										
	Variables	Intercept	B	SE	95% CI for (B)		df	p	OR	95% CI for Exp (B)	
					Lower	Upper				Lower	Upper
	Age (25–35)	1.077	1.453	0.689	-0.023	4.068	12	0.035	4.275	9.77E-01	5.85E+01
	Gender (male)		1.258	0.465	0.296	2.931	12	0.007	3.516	1.35E+00	1.88E+01
	Education level (Primary)		-3.563	1.293	-16.165	-2.101	12	0.006	0.028	9.54E-08	1.22E-01
	Model 2 (chimpanzee hunting)										
	Gender (male)	-3.81	1.25	0.578	0.315	3.071	12	0.031	3.48	1.37	2.16E+01
	Model 3 (chimpanzees meat eating)										
	Time living in the community	-1.249	0.472	0.186	0.109	0.965	12	0.011	1.602	1.115	2.625
	Model 4 (have been in the park at least once or know the park limit)										
	Number of children	3.344	0.85	0.362	0.184	1.996	12	0.019	2.34	1.202697	7.36
	Model 5 (opinion about park management by the community)										
	Age (25–35)	-1.379	-2.404	0.915	-18.837	-0.854	12	0.009	0.09	6.59E-09	0.425
	Age (36–45)		-1.749	0.837	-4.129	-0.152	12	0.037	0.173	0.016	0.858
Ordinal logistic regression	Model 6 (Opinion about chimpanzee population trend)										
	Education level (secondary)	2.309	1.867	0.8	0.578	23.557	15	0.02	6.468	1.783	1.70E+10
	Model 7 (respondents' opinion about the statement 'the park should be abolished')										
	Age (46–55)	1.234	1.475	0.694	0.28	3.149	10	0.033	4.373	1.323	23.322
	Age (≥56)		1.718	0.761	0.08	3.648	10	0.024	5.575	1.084	38.401
	Time spent in the community		-0.416	0.202	-0.936	-0.018	10	0.039	0.66	0.392	0.981
	Model 8 (opinion about relationship between the community and park authorities)										
	Gender (male)	2.71	0.671	0.308	0.015	1.402	9	0.029	1.956	1.015	4.064

Abbreviations: B, coefficients; CI, confidence interval; OR, Odds ratio; SE, stand error.

### 3.3 | Factors influencing the perceptions and attitudes of locals about chimpanzee conservation

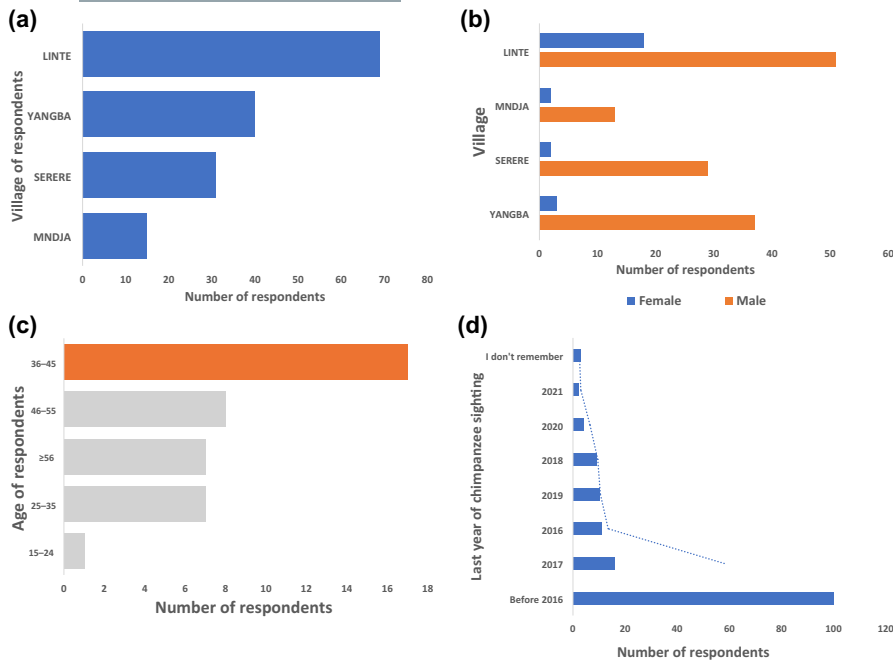
#### 3.3.1 | Factors influencing sighting of chimpanzees

Our first GLMM shows that chimpanzee sightings were influenced by three factors: age, gender and level of education (full-null model:  $\chi^2=40.31$ ,  $p=6.391e-05$ ). Chimpanzee sightings were positively associated with age and gender, but negatively associated with education level. Young respondents (age group 25–35, GLMM: B 1.453, OR 4.275, CI 0.976–58.45,  $p=0.035$ ), male (B 1.258, GLMM: OR 3.516, CI 1.34–18.763,  $p=0.007$ ) and primary educated (GLMM: B -3.563, OR 0.028, CI 9.537e-08–0.122,  $p=0.006$ ) were the most important predictor categories explaining the variation in the odds of seeing chimpanzees (Table 1, model 1). Young adult (aged 25–35) were more likely to have seen chimpanzees than respondents aged 15–24. Similarly, those without education

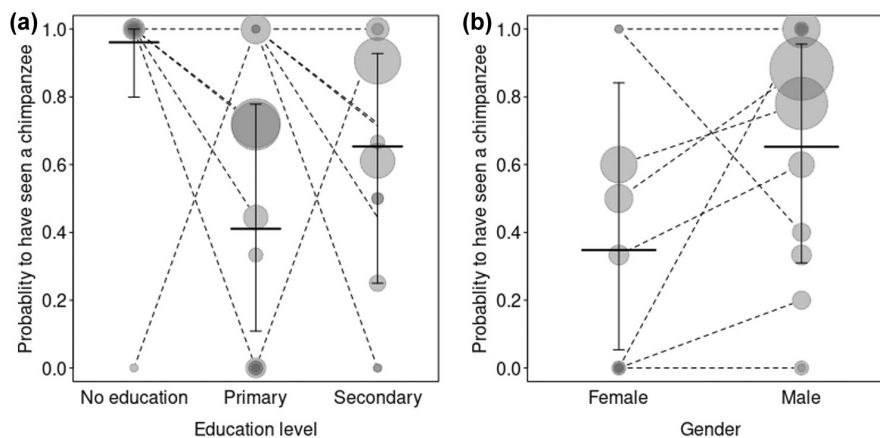
were more likely ( $p\sim 0.9$ ) to have seen chimpanzees, while those with secondary education were less likely ( $p\sim 0.65$ ) and those with primary education were less likely ( $p\sim 0.4$ ) (Figure 3a). Males were more likely to have seen chimpanzees ( $p\sim 0.65$ ) than females ( $p\sim 0.35$ ; Figure 3b).

#### 3.3.2 | Factors influencing the attitude towards chimpanzee hunting

In general, 19.3% ( $N=46$ ) of the interviewees acknowledged participation in chimpanzee hunting and 80.7% ( $N=192$ ) reported not participating. The reasons given for hunting were primarily local meat consumption and income generation (65.2%,  $N=30$ ) or rituals (34.8%,  $N=16$ ). The GLMM shows that gender ( $p=0.031$ ) significantly influenced attitudes towards chimpanzee hunting (full-null model:  $\chi^2=24.482$ ,  $p=0.017$ ). A negative intercept in this model



**FIGURE 2** Number of respondents who had seen chimpanzees according to village (a), gender (b), age (c) and year of observation (d).



**FIGURE 3** Effect of education level (a) and gender (b) on the probability of having seen a chimpanzee. The dots depict the observed probabilities. Each dot represents a combination of educational level and ethnic group (tribes), in which the area of the dots is proportional to the number of respondents (range = 1 to 36). The dashed lines connect the proportions of the same ethnic group. Horizontal line segments with error bars represent the fitted model and its 95% confidence limits for all other predictors, centred on a mean of zero.

means that the probability ( $p$ ) of hunting chimpanzees is less than 0.5. Males (GLMM: B 1.250, OR 3.48, CI 1.37–21.57,  $p=0.031$ ; Table 1, model 2) were more likely to be involved in hunting ( $p \sim 0.17$ ) than females ( $p \sim 0.1$ ; Figure 4).

#### Local perceptions based on cultural beliefs or taboos

Of those who answered the question: Are there any cultural prohibitions against chimpanzees in your culture? A total of 58.8% ( $N=140$ ) confirmed the existence of taboos related to chimpanzee, while 40.8% ( $N=97$ ) did not. The percentage of respondents who believed in the existence of taboos did not differ between villages ( $\chi^2=4.324$ ,  $p=0.778$ ). 71.7% ( $n=172$ ) of the interviewees confirmed that they use chimpanzees body parts in traditional medicine (all always claim to use mainly bones and hair for various

treatments and rituals). The percentage of respondents using chimpanzees in such a way did not differ between villages ( $\chi^2=3.24$ ,  $p=0.47$ ) and was also not affected by the main occupation of the respondents ( $\chi^2=2.14$ ,  $p=0.99$ ).

#### 3.3.3 | Factors influencing the consumption of chimpanzees by local people

In general, 65.7% ( $N=157$ ) of the respondents reported that they did not eat chimpanzees, while 34.3% ( $N=82$ ) reported the contrary. Village ( $\chi^2=7135$ ,  $p=0.309$ ), the level of education ( $\chi^2=14,166$ ,  $p=0.78$ ) and the main occupation ( $\chi^2=1067$ ,  $p=0.983$ ) had no effect on the percentage of respondents eating



chimpanzees. The most common reason given for not hunting or eating chimpanzees was that chimpanzees are considered to be human by 42.9% of the respondents, while 9.1% stated that chimpanzees are a totem, and others simply argued that they are following their tradition (17.5%) or religion (11.0%). Religious restrictions were particularly noted among Muslims, who told us that they do not eat dead animals that are not slaughtered their religious rules. For those respondents who did believe in the existence of taboos, only a few told us that chimpanzees are considered a 'sacred animal', explaining that it is culturally forbidden to hunt or eat their meat. A respondent from MINDJA village said that 'if I eat chimpanzee meat, I will become a leper', while two others from LINTE village said that 'if I eat chimpanzee meat, it will have disastrous consequences in the village'.

The GLMM shows that the time spent in the community significantly ( $p=0.011$ ) influenced whether the respondents ate chimpanzees or not (full-null model:  $\chi^2=18.104$ ,  $p=0.013$ ). Although the intercept in this model was negative (meaning that the probability ( $p$ ) of eating chimpanzees is less than 0.5), the time spent in the community was positively associated with eating chimpanzees, suggesting that the probability of eating chimpanzees increases with the time spent in the community. Therefore, for every unit (year in our case) increase in the time spent in the community by the respondent, the probability of eating chimpanzees gets 1.6 times higher. (GLMM: B 0.472, OR 1.60, CI 1.115–2.625, Table 1, model 3).

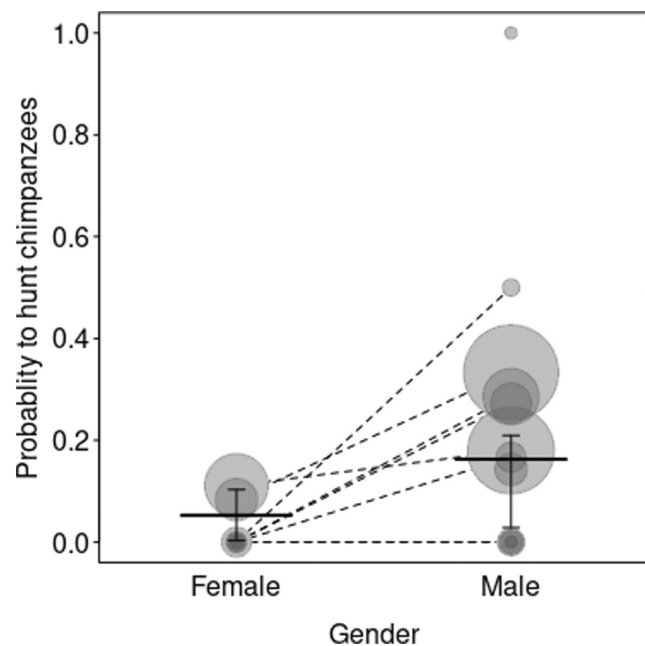


FIGURE 4 Effect of gender on the likelihood of hunting chimpanzees. The dots depict the observed probabilities. Each dot represents a combination of gender and ethnic group, in which the area of the dots is proportional to the number of respondents. The dashed lines connect the proportions of the same ethnic group. Horizontal line segments with error bars represent the fitted model and its 95% confidence limits for all other predictors, centred on a mean of zero.

### 3.3.4 | Factors influencing the presence of respondents in the park

In total, 92.5% ( $N=221$ ) of the interviewees stated that they had previously visited the park, while 7.1% stated that they had not. Village ( $\chi^2=15.104$ ,  $p=0.11$ ) or the main occupation ( $\chi^2=12.15$ ,  $p=0.20$ ) had no effect on the probability of having visited the park. The regression analysis indicated that the number of children in a household influenced the likelihood of visiting the park ( $p=0.019$ ; full-null model:  $\chi^2=18.104$ ,  $p=0.011$ ). For each additional child in the household, the probability of visiting the park increased by 2.340 units (B 0.850, OR 2.340, CI 1.202–7.360; see Table 1, model 4).

#### Knowledge of the laws to protect chimpanzees

In general, 93.7% ( $N=194$ ) of the respondents confirmed that they were aware of the laws protecting chimpanzees in Cameroon, while 6.3% ( $N=13$ ) were unaware. Here, we found that the percentage differed between the villages ( $\chi^2=10.104$ ,  $p=0.011$ ), highlighting the uneven sensibilization activity of local residents in the whole village by the conservationist or park officials.

### 3.3.5 | Factors influencing the opinion of the respondents about park management by the community

Respondents were asked if the community could manage the park if the government decided to give up. Only 11.1% ( $N=26$ ) of the respondents expressed a negative opinion (referring to 'yes' to the question), while 85.9% ( $N=201$ ) exhibited a positive opinion (i.e., 'no'). The remaining 3.0% ( $N=7$ ) had no opinion. The results of the regression analysis (Table 1, model 5) indicate that the age of the respondents influenced their opinion (full model  $\chi^2=17.031$ ,  $p=0.014$ ). A negative intercept in the model implies that the probability ( $p$ ) of expressing a positive opinion is less than 0.5. However, the young adults (25–35 years old, GLMM: B  $-2.404$ , OR 0.090, CI  $6.593e-09-0.425$ ,  $p=0.009$ ) and medium adults (36–45 years old, B  $-1.749$ , GLMM: OR 0.173, CI 0.016–0.828,  $p=0.037$ ) had a negative opinion, indicating that both groups were less likely to report a positive opinion compared to younger respondents from the age group 15–24. The  $p$ -value for older adults was not significant ( $p=0.872$ ).

#### Respondents' opinions on the decline of the chimpanzee population

Regarding the question 'Will we face chimpanzee extinction in the park?', more than half of the respondents (58.8%,  $N=141$ ) answered 'no', 31.67% ( $N=76$ ) answered 'yes' and 8.75% ( $N=21$ ) stated had no opinion on the matter. Of the people who answered 'no', most (59.6%,  $N=84$ ) stated that humans no longer kill chimpanzees, while others (43.3%,  $N=61$ ) reasoned that chimpanzees produce offspring and therefore their populations will never disappear. However, those who answered 'yes' attributed the risk of extinction to hunting (65.8%  $N=50$ ), while others (34.2%,  $N=26$ ) think that habitat conversion into agriculture and livestock grazing increases the risk. Also,

because they no longer see chimpanzees in the park, they assume that chimpanzees no longer exist there.

### 3.3.6 | Factors influencing respondents perception about chimpanzee population trends

Of the 156 respondents who reported a trend in the chimpanzee population, 42.3% ( $N=66$ ) perceived it as high or increasing, 32.7% ( $N=51$ ) as decreasing, 4.5% ( $N=7$ ) as stable and 20.5% ( $N=32$ ) had no opinion (Figure 5a). The regression analysis for the population trend model showed that the level of education influenced perception (full-null model:  $\chi^2=14.104$ ,  $p=0.001$ ). The model suggests that respondents with secondary education exhibited a more positive perception, with odds 6.448 times greater (GLMM: B 1867, OR 6.468, CI 1.783–1.701e+10,  $p=0.02$ ; Table 1, model 6).

#### Attitude of the respondents towards support for chimpanzee conservation

87.0% ( $N=180$ ) of the respondents recognized the conservation of chimpanzees as a good initiative, while 6.3% ( $N=17$ ) did not, 2.9% ( $N=4$ ) had no opinion, and 3.8% ( $N=6$ ) stated that we do not need to protect them. The answers varied according to the level of education and gender. Female with primary and secondary education were more likely to have a positive opinion while men with the same education level were not (Figure 5b).

### 3.3.7 | Factors influencing respondents' opinions about the statement 'the park should be abolished'

Approximately 81.0% ( $N=192$ ) of the participants answered that the park is community property, while 6.8% ( $N=16$ ) perceived it as belonging to the government, and 10.6% ( $N=25$ ) acknowledged

the ownership of both parties. Furthermore, 15.9% ( $N=37$ ) of the respondents agreed with the abolishment of the park, while 70.8% ( $N=167$ ) disagreed and 13.6% ( $N=32$ ) had no opinion. Between villages, no differences in the percentage of the respondent were found ( $\chi^2=14.12$ ,  $p=0.115$ ). However, the answers depend on age and time spent in the community (OM) (full-null model:  $\chi^2=7.656$ ,  $p=0.015$ ). Older adults (age 46–55, GLMM: B 1475, OR 4.373, CI 1.323–23.322,  $p=0.033$ ) and (age  $\geq 56$ , GLMM: B 1718, OR 4.373, CI 1.323–23.322,  $p=0.033$ ) gave more likely a positive answer. On the contrary, the time spent in the community was negatively correlated (GLMM: B -0.416, OR 0.660, CI 0.392–0.981,  $p=0.039$ ), indicating that as the time spent in the community increases, the more negative will be the answer (Table 1, model 7).

#### Attitude of the respondents towards the current park management system.

Approximately 72.0% ( $N=154$ ) of the respondents indicated satisfaction with the current government management system, while 28.0% ( $N=60$ ) expressed disappointment. However, we observed a difference in the proportion of satisfied respondents between villages ( $\chi^2=14.12$ ,  $p=0.02$ ). Although most of the respondents believed that the park is owned by the local community, 85.9% of them stated that the community cannot manage the park due to lack of training and funds.

### 3.3.8 | Factors influencing the opinion of the respondents about the statement 'The relationship between the local community and the park officials is good'

Regarding the statement above, 61.8% ( $N=146$ ) of the respondents agreed, 16.1% ( $N=38$ ) disagreed and 22.0% ( $N=52$ ) were neutral. The regression model (OM) showed that only gender had an effect (full-null model:  $\chi^2=13.434$ ,  $p=0.011$ ). Males viewed the

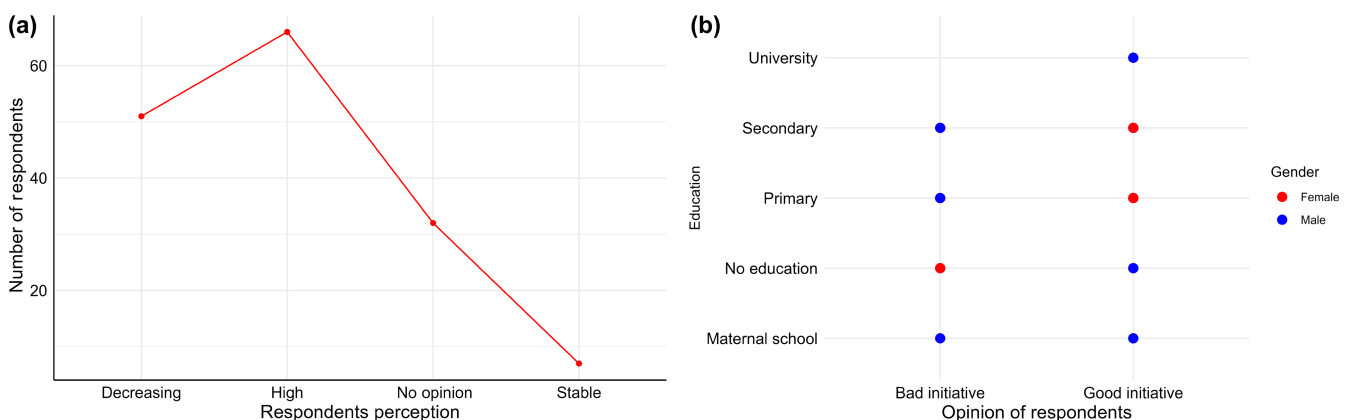


FIGURE 5 Opinion of the respondents about chimpanzees' population trend (a) and effect of education level and gender on their opinion regarding the initiative to conserve chimpanzees (b).

relationship rather positively than females (GLM:  $B = 0.671$ ,  $OR = 1.956$ ,  $CI = 1.015-4.06$ ,  $p = 0.029$ ), with odds 1.956 higher (Table 1, model 8).

### 3.4 | Human-wildlife conflict in the area

Farming was the main activity found, and 75% of the crops cultivated included cocoa (*Theobroma cacao*), banana (*Musa* spp.), cassava (*Manihot esculenta*), groundnuts (*Arachis hypogea*), maize (*Zea mays*) and sweet potato (*Ipomoea batatas*). All respondents ( $N = 233$ ) reported no conflicts with chimpanzees. However, 98.7% ( $N = 230$ ) of the respondents reported crop attacks by other species, such as crested porcupine *Hystrix cristata* and other rodents (20.2%); monkeys, especially the tantalus monkeys *Chlorocebus tantalus* (59.7%), red river hogs *Potamochoerus porcus* and some ungulates, for example the blue duikers *Philantomba monticola* (20.1%).

Almost half of the respondents (48.7%,  $N = 112$ ) who were victims of crop raiding reported no reaction when attacked, and 36.5% ( $N = 84$ ) retaliated by inviting hunters to their farms or using poison and traps. A minority of the respondents (6.1%,  $N = 21$ ) reported informing the wildlife management authority, while 3.9% ( $N = 13$ ) reported repelling crop thieves. The estimated minimum amount of losses was 20,000 CFA, while the maximum was 2,000,000 CFA with an average of 313,798 CFA. The average losses reported by the respondents of the four villages did not differ (ANOVA:  $F = 0.123$ ,  $p = 0.46$ ).

## 4 | DISCUSSION

Sustainable conservation of natural resources and biodiversity is more successful if local people are involved and if conservationists understand the relationships and interactions between local people and the natural environment and its wildlife (Malmer et al., 2020). Thus, a positive attitude of local people towards wildlife and conservation is a key factor for the survival and management of a threatened species (Alexander, 2000). Therefore, baseline data on the ecological knowledge of local populations (LEK), the magnitude of human-wildlife conflicts, the attitudes, and opinions of people towards wildlife and their perception of conservation measures are essential. Such data have been missing for the chimpanzee conservation initiative in Mpem and Djim National Park and we collected corresponding site-specific information that will be used in targeted conservation planning. As in many other parts of Cameroon, farming is the main source of income for people living in villages close to the national park (Fominka et al., 2021; Kamgang et al., 2021). In general, the people we interviewed had good LEK about chimpanzees and expressed a positive attitude towards their conservation. Similar results were also found in other areas in Cameroon (Njukang et al., 2019) and in Guinea (Sousa et al., 2014), suggesting that residents of rural communities can act as local allies and actors for the successful conservation of chimpanzees.

As in other regions of Cameroon (Angwafo & Chuo., 2016; Chuo & Angwafo, 2017), chimpanzee-related taboos such as bans to hunt or eat chimpanzees, persist in villages around MNDP. However, inadequate living conditions, mainly characterized by poverty and low income, can force people to disregard traditional beliefs, and thus reducing the chances of survival of chimpanzees. On the other hand, we found that chimpanzee body parts are still used in traditional medicine, a practice that was also reported by Angwafo and Chuo. (2016) and Kamgang et al. (2021). However, in our study, only a few respondents reported being involved in this practice, which might be an indication that this tradition is fading or that people are not willing to talk about it.

A worrying result of our study is that sightings of chimpanzees by local people became very rare after 2016. This trend converges with our observation of a drop in chimpanzee abundance in the park (Ernest Fotsing, unpublished data). The reasons for the decrease are not clear. Poaching might be important here, while some respondents attributed it to the expansion of agriculture at the expense of chimpanzee habitat. However, unlike in other studies (Adeola et al., 2018; Gatara & Tekalign, 2021; Kamgang et al., 2021; Ogunjobi, 2017), respondents in our study did not report any human-chimpanzees conflict.

As predicted, the frequency of chimpanzees sightings was associated with respondents' the age, gender and education level of respondents. Less educated residents, young adults and men reported more sightings, most likely because of their higher degree of outdoor activities often close to the forests. On the contrary, people with higher education may have predominantly outside of the agricultural sector and therefore miss opportunities to see chimpanzees in the forest (Lozano et al., 2019). On the other hand, these people reported a more positive perception towards chimpanzee conservation, most likely because of a deeper understanding of ecological concepts and the importance of conserving their natural heritage. However, the impact of age and gender on LEK about chimpanzees is somehow controversial. Some studies find similar effects as in our study (Gebo et al., 2022; Sousa et al., 2014; Teixeira et al., 2021), where other studies did not (Junior et al., 2016; Zhang et al., 2020). These differences are discussed as reflecting varying histories and tradition of forest use among local communities (Da Silva Costa et al., 2023). As in other studies (Da Silva Costa et al., 2023), male respondents in our study showed higher LEK than women. Women reported less sightings and thus direct experience with chimpanzees. This gender difference is most likely the result of the social roles and labour activities of women and men (Souto & Ticktin, 2012). Indeed, we acknowledge the possible influence of gender imbalance on all the results associated with the gender due to the higher number of male respondents compared to females. Fortunately, this gender imbalance was unexpected in our study because, on the one hand most interviewed men were single or widowed and for other men, their wives were not present the day of the interview visit on the other hand. Furthermore, some women we met at home expressed unwillingness to participate, while others immediately refused to

be interviewed, stating that they have no ideas about the forest and that only men are familiar with. The higher number of male participants may therefore reflect cultural factors influencing participation in our study.

In general, mammals that are more charismatic (e.g. chimpanzees) can have a positive effect on residents' attitudes, commitments or their willingness to contribute in conservation efforts (Bruner et al., 2005; White et al., 2001). Such impacts have been found, for example by Da Silva Costa et al. (2023) in a study on *Sapajus flavius* in Brazil. Nevertheless, a relative high proportion of respondents (19.3%, mostly men) reported involvement in chimpanzee hunting, eating chimpanzee meat or using of body part in traditional medicine. Given that people are often reluctant to share information about illegal activities, particularly with people perceived as connected to local authorities or as 'conservationists', this proportion might even be higher. However, some social groups do not eat chimpanzees either because for religious reasons (particularly Muslims) or because they consider chimpanzees to be too similar to humans. Such justifications were also reported in other studies, for example Cormier and Urbani (2008) and Ellwanger et al. (2015). Our findings also emphasize that the increase in time spent in the village corresponds to a greater desire to eat chimpanzees and a less positive attitude towards the park and chimpanzee conservation, potentially rooted in dissatisfaction with the management of the park by officials and the belief that the park belongs to the local community. According to Pinto-Marroquin and Serio-Silva (2020), people who eat chimpanzees may have also learned from outside poachers or migrants. In line with our predictions, the correlation between age, time spent in the community and respondents opinions regarding the fact that the park should be abolish or managed by local community was also found by Da Silva Costa et al. (2023) suggesting that older individuals and people who had lived in the area for longer exhibited a higher LEK score. However, in natural resource-dependent communities as in our study area, LEK acquired at a young age can increase over years, resulting in older people being more knowledgeable than younger ones (Da Silva Costa et al., 2023). People who have spent many years in such areas tend to be more aware of their natural surroundings, are more likely to observe animals, and accumulate more information about them (e.g. trend over time) as well as towards park management and conservation activities (Ellwanger et al., 2015; Sousa et al., 2014). If the park is not well managed, these people may be disappointed and could exhibited negative opinions about chimpanzees conservation and the park. However, we did not expect respondents to be very empathic (willing their children to also see chimpanzees in the future) towards chimpanzees, as most of them do not agree that the park should be abolished, and were also in favour of chimpanzee conservation, which is good for the future survival of chimpanzees in MNDP. Similarly, the number of children helps to explain the respondent's presence in the park suggesting that having a larger family is inversely related to being more pro-conservation as this increase forest dependence (Mendako et al., 2022) and in

consequence the likelihood to be in contact with chimpanzees. In contrast to our predictions, we got a lack of influence of distance from respondents village to park and their main occupation on people's attitudes, perceptions and opinions for all models fitted, indicating that respondents behaviour towards the park and the chimpanzees remains the same regardless of activity and location.

Contrary to our predictions, we found a large percentage of respondents that were aware of the Cameroon constitution law that prohibited killing or hunting chimpanzees. Most respondents also exhibited a satisfaction regarding how the park is managed by the officials, but this percentage varies between villages. A possible explanation is the lack of environmental education and the unequal participation of residents of all the villages in conservation activities. Major costs of conservation are generally incurred by local people which suffer from the presence of species (Heinen, 1995). It is therefore clear that wildlife conservation depends on local people attitudes and actions regarding the exploitation of natural resources. For example, people living around the Kosi Tappu Wildlife Reserve in southern Nepal had very negative attitudes towards the reserve, complaining in particular about the presence of wild buffalo, which caused some crop damage (Heinen, 1993). Socioeconomic assessments, public participation and education programmes therefore appear as a first step in any conservation programme (Heinen, 1995). Conservation initiatives fail when local people's opinions are not considered, as seen in Kenya's Tana River Reserve (Mboru & Meikle, 2004).

The main limitations of this study include the complexity of the questionnaire, the high number of questions, the time taken to complete the questionnaire and the fact that some respondents seemed to be in a hurry to complete it quickly, the potential reluctance and dishonesty of some participants who were uncomfortable discussing negative issues about chimpanzees or how the park is managed by officials, the religious beliefs of some respondents, the uneven size of the respondents population across the villages surveyed, and the gender imbalance, which also had an impact on our results. Despite these issues, relevant information was collected from the studied community. Furthermore, conservation education programmes (CEP) should integrate the social processes in local communities. Environmental education is commonly targeted at children or students but, to mitigate the risk of future wildlife, particularly chimpanzees extinction in the area, we suggest directing CEP towards specific demographic groups within all the village. These may include individuals with larger families, limited formal education, advanced age like older adults, native people and individuals with limited LEK. The government also needs to implement multiple measures for infrastructure development in the area such as the creation of employment opportunities, schools and hospitals. Regarding MNDP management, it should be important to take into account social variables such as population density, the extent of ethnic diversity and the level of economic disparity as have suggested Heinen (1996). Future research could also aim for a more balanced gender representation or to better understand how factors not assessed here (e.g. personal

experience and environmental education in or outside schools), affect local people's attitude towards chimpanzees.

## 5 | CONCLUSIONS

Social research, especially within the protected area, can help to get into the perceptions of local people, and the result can contribute to the harmonious development of nature conservation and therefore can generate important benefits for local people. The purpose of the study was to understand how the spatial proximity between chimpanzees and humans can shape people's attitude, perception, opinions and knowledge. Our findings indicated that the local community strongly agrees with the conservation of chimpanzee by showing good LEK towards them. However, it was clear that the conservation benefits are not well distributed in different villages, therefore, shaping the local perception towards chimpanzee conservation. Gender, age, household size, time living in the community and education level help predict people's attitudes and perceptions about chimpanzee conservation. We also found that the perception and attitude of the respondents were independent of their location and their main occupation. Based on our results, the current study could be used (1) as a baseline data set for future studies, (2) as a basis to develop a sustainable conservation strategy that promotes human–chimpanzee coexistence, (3) to generate future research questions and hypotheses, as well as (4) a proxy when resources are limited.

### AUTHOR CONTRIBUTIONS

Ernest D. B. Fotsing: Conceptualization; methodology; data collection and analysis; writing a grant proposal; preparing the original and final draft. Meigang M F. Kamkeng: Conceptualization; methodology; data collection; project administration; writing and editing the draft. Dietmar Zinner: Supervision; contributed critically to the drafts. All authors gave their final approval for publication.

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### CONFLICT OF INTEREST STATEMENT

The author(s) declared that there are no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

### DATA AVAILABILITY STATEMENT

All data are archived on the first author GitHub repository account and can be found at [https://github.com/Fotsing2023/PeopleOpinions\\_SocioEcology\\_Publication.git](https://github.com/Fotsing2023/PeopleOpinions_SocioEcology_Publication.git) or by cloning the repository using SSH key below: [git@github.com:fotsing2023/peopleopinions\\_socioecology\\_publication.git](mailto:git@github.com:fotsing2023/peopleopinions_socioecology_publication.git).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**Supplementary Material 1:** Questionnaires.

**Supplementary Files 2a.** Summary of different model fitted.

**Supplementary Files 2b.** Signification of abbreviation.

**Supplemental File 3.** Summary of significant predictor variable.

**Supplementary Material 4. Table S1.** Demography of interviewees in villages around Mpem and Djim National Park, Cameroon.

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