

**Exploring Local Perceptions of and Attitudes toward Endangered François'
Langurs (*Trachypithecus francoisi*) in a Human-modified Habitat**

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Running title: Local Perceptions of and Attitudes toward *Trachypithecus francoisi*

Data Availability

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgement

We thank UNI.COO Project (No.: 27164) of University of Turin, Italy and Primate Conservation Inc., USA (No.: PCI #1394) for funding this survey. We appreciate the editor-in-chief, Dr. Joanna Setchell, so much for her great support in submission of this longer manuscript. We are grateful to Dr. Joanna Setchell and three anonymous reviewers for their excellent comments on an earlier version of this manuscript. We thank the Department of Guizhou Forestry, MNRR Administration and the Qinglong community committee for permissions to implement this survey in Qinglong village, China. We want to give our sincere thanks to all the respondents in Qinglong village who graciously participated in this research. During the survey, we received invaluable support from Director Weiyong Zhang (Fanjingshan National Nature Reserve Administration), Director Luming Wei (MNRR),

Guoyong Xiao, Zhijin Xiao and Bo Liu in Qinglong village, and staff members Lei Shi (FNRR), Qixian Zou, Peng Zhang, Xiugang Yan and Xiaolin Mao (MNRR). We would like to express our gratitude to Shaoguo Peng from Hongyan village and Peng Yang, Lianlian Luo, Qunfeng Wu, and Chong Ran from Tongren University for their assistance with interview surveys. We are lucky to have the help from Dr. Chia L. Tan (LVDI International, USA) and Qi Mu (Politecnico di Torino, Italy) on the project and manuscript preparation. Special thanks to the "San Paolo Company (Compagnia di San Paolo)" Foundation for support of Niu's Ph.D. Scholarship in University of Turin, Italy.

Author Contributions: KN, TY, ZX, AW and YY designed questionnaire, KN and TY collected the data, KN and WL analyzed the data and developed methodology, KN led the writing with contributions from WL and ALE. AA, CG, MG and IR provided editorial advice and revised it for accuracy and content, and all the authors approved the final version of the manuscript.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

1 **Title:** Exploring Local Perceptions of and Attitudes toward Endangered François' Langurs
2 (*Trachypithecus francoisi*) in a Human-modified Habitat

3 **Abstract** Understanding local community attitudes toward wildlife is critical for making
4 context-sensitive conservation planning and management decisions that may facilitate better
5 human-wildlife coexistence. We conducted questionnaire-based interviews with local
6 households in the Qinglong village of Mayanghe National Nature Reserve (MNNR) in
7 China from March to August 2015. We used a mixed analysis technique based on a
8 theoretical framework of categorical variables to explain attitudes to investigate the key
9 factors that influenced local attitudes toward Endangered François' langurs (*Trachypithecus*
10 *francoisi*). We found that 53% (40, $N = 75$) of interviewees liked François' langurs presence
11 around the village; 27% did not; and 20% were neutral. Respondents with favorable attitudes
12 to langurs associated them mainly with tangible benefits from local tourism and their
13 positive aesthetic and emotional values. Respondents with negative attitudes to langurs
14 associated them with tangible costs such as crop feeding and the destruction of their houses.
15 Over half ($N = 9$) of respondents with neutral attitudes associated langurs with various cost
16 and benefit trade-offs. Overall, local people tended to have slightly negative perceptions of
17 the langurs' impacts at the household level, while they had very positive perceptions of their
18 impacts at the community level. Ordinal logistic regression models revealed that age, gender,
19 and impact perceptions were significantly associated with local residents' attitudes towards
20 the langurs at the household and community levels. We suggest that such socioeconomic
21 monitoring efforts should be periodically conducted in protected areas like MNNR,
22 especially in the context of rapid economic and infrastructure development.

23 **Key words:** Local Attitudes and Perceptions · Human and Primate Co-existence · Primates
24 Conservation · Ethnoprimateology · China · Theoretical Framework of Categorical
25 Variables · Perceived cost and benefit

26 **INTRODUCTION**

27 Humans have been identified as a substantial causal factor of the sixth mass
28 extinction (Ceballos *et al.* 2015; Corlett 2015). To promote effective conservation of
29 biodiversity for the maintenance of ecosystem processes and for human survival, it is essential
30 to understand the interactions between wildlife species and the relevant stakeholders
31 (Manfredo 2008; Rands *et al.* 2010). The local community is one of the most important
32 stakeholders in wildlife conservation and protected area management because local people
33 share the ecosystem with wildlife and interact with it (Nepal 2002). The livelihood needs of
34 local people, desires for economic development, and top-down approaches to conservation
35 have led to low participation of local people in wildlife conservation in most developing
36 countries (Abrams *et al.* 2009; Adams *et al.* 2004). The relationship between local residents
37 and wildlife may be additionally strained when there is conflict between them (e.g. Lee and
38 Priston 2005). For conservation initiatives to succeed, we need to understand human-wildlife
39 relations and incorporate local stakeholders in the decision-making process through
40 evidence-based management (Nepal 2002).

41 Attitudes can be defined as an individual's disposition to respond with some degree of
42 favorableness, or not, to an object, person, or event, or any other discriminable aspect of the
43 individual's world (Ajzen and Fishbein 1980). Understanding the factors which shape

44 attitudes towards human-wildlife conflict is important in predicting human behavior and
45 mitigating conflict (Manfredo and Bright 2008). Individuals' attitudes toward animals may
46 vary with the needs of the person and the degree to which they perceive these needs have
47 been met (Manfred 1991; Maslow 1943). This leads to a complex psychological determinant
48 system with diverse variables involved (e.g. intangible and tangible cost and benefit
49 perceptions, knowledge of wildlife, exposure and experience with wildlife, species
50 characteristics, socio-demographic variables) (Kansky and Knight 2014). The perceived
51 costs and benefits of wildlife have generally been considered the primary determinants of
52 attitudes toward wildlife (Chan *et al.* 2007; Linnell *et al.* 2010). A meta-analysis of the
53 variables predicted to affect the attitudes of people living in areas with wildlife towards large
54 mammals found that intangible costs were the most important category of factors explaining
55 people's attitudes (Kansky and Knight 2014). However, this conclusion may have some
56 limitations as the majority of publications were studies involving carnivores (Kansky and
57 Knight 2014)

58 The relative importance of cost and benefit categories and other categories to explain
59 attitudes may vary for different animal species (Kansky and Knight 2014). Interactions
60 between wildlife and people varied across a wide range of contexts (Kansky *et al.* 2014). If
61 researchers do not include a comprehensive range of interactions in their studies, results
62 concerning local people's attitudes towards wildlife might not reflect their actual perceptions.
63 Researchers often focus on costs or conflicts rather than benefits when attempting to
64 understand people's attitudes toward wildlife (Kansky and Knight 2014; Sekhar 2003).
65 However, tangible benefits may be very important, especially if the species contributes

66 positively towards people's livelihoods (Sekhar 2003). For example, infrastructure
67 development programs to support sustainable wildlife use in critical habitats may contribute
68 tangible benefits for local people. If these efforts are linked with conservation initiatives,
69 they can create positive conservation attitudes (Ellwanger *et al.* 2015; Xiang *et al.* 2011). In
70 addition, the importance of intangible costs, such as the hidden health, opportunity and
71 transaction costs of human–wildlife conflict has been recognized recently (Barua *et al.* 2013)
72 while intangible benefits such as positive emotions, aesthetic or cultural values as well as
73 ecosystem services have been less explored (Kansky and Knight 2014). By incorporating a
74 range of variables to investigate what influences attitudes (e.g. intangible costs or benefits),
75 we can improve our understanding of how attitudes shape conservation outcomes.

76 Nonhuman primates (hereafter primates) are a salient aspect of the environment for
77 human communities that share space with these animals (Estrada *et al.* 2017; Hvenegaard
78 2014; Lee and Priston 2005). Local people's perceptions of and attitudes towards primates
79 have received considerable attention (e.g. Alexander 2000; Chalise and Johnson 2005; Knight
80 1999; Lee and Priston 2005). More recently, studies using an ethnoprimateological approach
81 have demonstrated that a comprehensive framework for understanding the dynamic
82 interactions between local stakeholders with different attitudes and sympatric primate species
83 can mitigate conflict and promote co-existence (e.g. Fuentes and Hockings 2010; Riley and
84 Priston 2010; Setchell *et al.* 2017; Sousa *et al.* 2014). Similar to Kansky and Knight's (2014)
85 conclusion, several studies have showed that a negative emotional connection (i.e., fear of
86 animals) might shape negative perceptions of species (Campbell-Smith *et al.* 2010; Sousa *et*
87 *al.* 2014). In other cases, the animals' human-like appearance and behavior or positive

88 traditional folklore inform positive perceptions of primates (e.g. Costa *et al.* 2013; Dore *et al.*
89 2018a; Riley and Priston 2010; Xiang *et al.* 2010). Some researchers have examined how crop
90 foraging or the economic benefits of ecotourism can influence local residents' perceptions of
91 and attitudes toward endangered primates (Ellwanger *et al.* 2015; Hill 2000; McLennan and
92 Hill 2013; Setchell *et al.* 2017; Sousa *et al.* 2014). When crop foraging was associated with
93 more negative perceptions of the species concerned, the perceived benefits of primate-based
94 tourism provided balance to attitudes, likely positively influencing the human-primate
95 relationship (Ellwanger *et al.* 2015; Hill 2000, 2005; Knight 1999; Xiang *et al.* 2011).
96 Furthermore, socio-demographic factors (e.g. Ellwanger *et al.* 2015; Rocha and Fortes 2015)
97 or local knowledge of species (e.g. Ellwanger *et al.* 2015; Reibelt *et al.* 2017; Sousa *et al.*
98 2014) have been linked with local perceptions of and attitudes toward primates on a
99 case-by-case basis. However, a lack of conceptual clarity to guide the selection of variables in
100 attitudinal research may fail to effectively compare the drivers of attitudes across a broad
101 range of primate species and societies (Kansky and Knight 2014). This makes it difficult to
102 build a comprehensive theory and investigate broader patterns of factors that determine
103 attitudes towards primates or other wildlife. Hence primatologists need a theoretical
104 framework with greater conceptual clarity for future research on attitudes toward primates so
105 as to allow for greater consensus on the identification, categorization, and evaluation of the
106 importance of attitudinal variables across a wide range of studies.

107 China is home to 1.4 billion people and 693 mammalian species (Jiang *et al.* 2016,
108 2017). Over-exploitation by humans, habitat loss and human interference are the three
109 leading threats to many of these animals (Jiang *et al.* 2016). Among them, 25 species of

110 primates are highly threatened in China (Li *et al.* 2018). A new national park system has
111 been recently proposed and piloted, with the intention of promoting harmonious coexistence
112 between human and nature (overall plan on the development and management of national
113 parks 2017). In this national plan, local residents in the “gate community”, which refers to
114 key communities living near and around national parks, are encouraged to participate in
115 nature education programs and co-management of the ecosystem. Although examining
116 attitudes within a particular context is helpful for wildlife conservation and the engagement
117 of local residents, there are few studies on local perceptions of and attitudes toward primates
118 and other flagship wildlife in China (e.g. Guizhou snub-nosed monkeys *Rhinopithecus*
119 *brelichi*, Ellwanger *et al.* 2015; Asian elephant *Elephas maximus*, He *et al.* 2011). Here, we
120 explore local attitudes toward the Endangered François' langur (*Trachypithecus francoisi*)
121 (Bleisch *et al.* 2008), based on Kansky and Knight's (2014) theoretical framework of
122 categorical variables. The approach enables the identification of specific and significant
123 variables explaining attitudes to the langurs which would help develop targeted conservation
124 programs in China. It also generates a broader pattern of categorical variables with greater
125 conceptual clarity to explain attitudes for further comparisons across species and across
126 cultures.

127

128

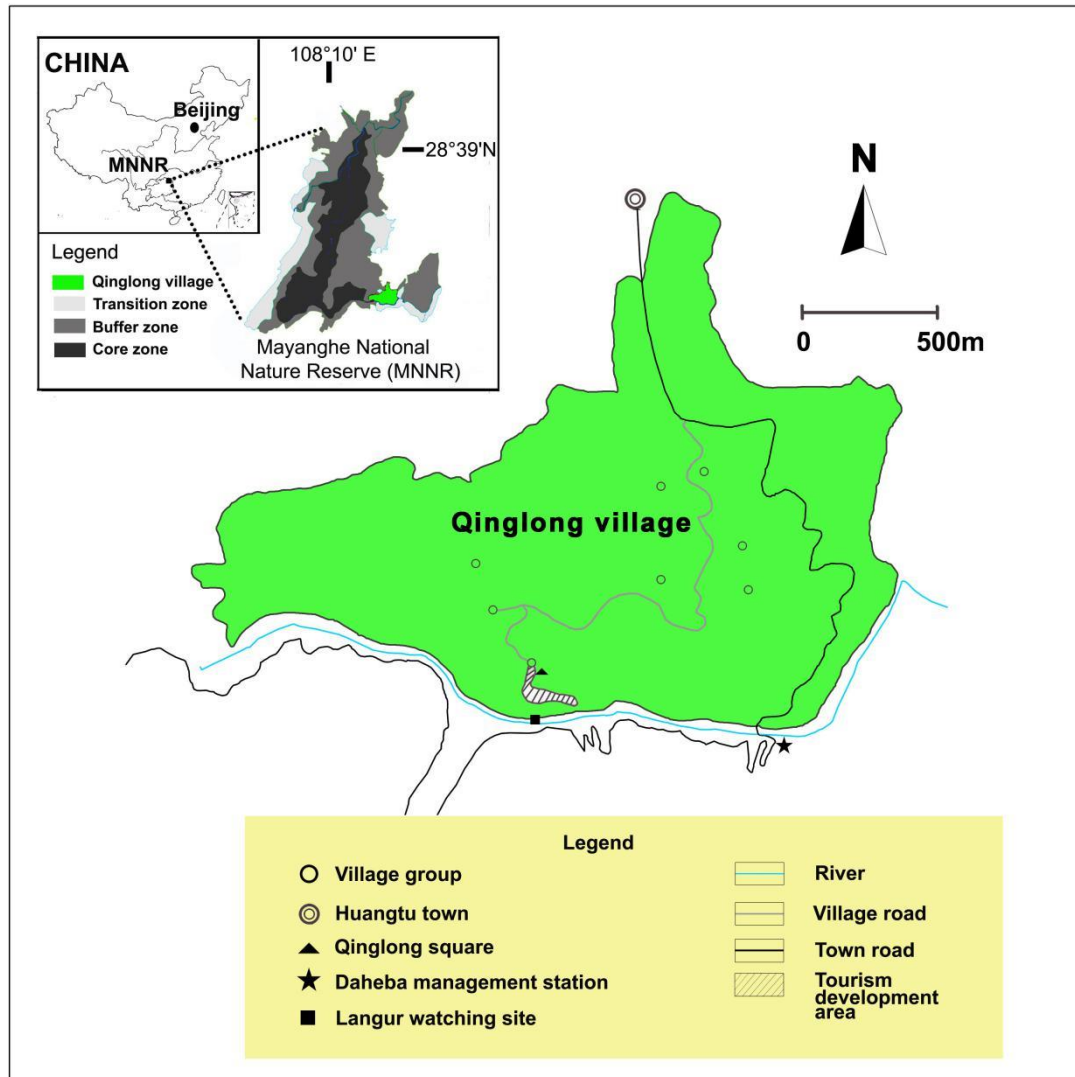
129 **METHODS**

130 **Species and Study site**

131 The François' langur is a medium-sized primate. It is distributed in 30 isolated

132 locations in the limestone hills and valleys of Northern Vietnam and Southern China (Li *et al.*
133 2007; Nadler *et al.* 2007; Niu *et al.* 2016). The langurs' survival is mostly threatened by
134 hunting and habitat loss and fragmentation (Hu *et al.* 2004; Li *et al.* 2007; Nadler *et al.* 2007;
135 Niu *et al.* 2016). Our latest review indicates that the global wild population of François'
136 langur has decreased to around 1,700 individuals and about 70% of the subpopulations have
137 fewer than 50 individuals (Author in prep.). The François' langur is classified as Endangered
138 by the IUCN Redlist and as a Category I species under the Wildlife Protection Act in China
139 (Bleisch *et al.* 2008; Niu *et al.* 2016). The conservation status of this species warrants urgent
140 attention.

141 Mayanghe National Nature Reserve of China (MNNR, Fig. 1, N28°37'33" ~
142 28°54'27", E108°3'39" ~ 108°20'25") is located at the junction of Yanhe County and
143 Wuchuan County of Guizhou province, one of the poorest regions in China (Zhu *et al.* 2017).
144 It was established in 1987 as a provincial nature reserve to protect François' langurs and their
145 habitat. In 2003, it was upgraded to a national nature reserve. MNNR is about 31,113 ha,
146 consisting of core (10,543 ha), buffer (10,522 ha) and transition (5,548 ha) zones (Fig. 1)
147 (Zhu *et al.* 2017). In 2015, there were about 23,000 human residents living in MNNR. Tujia
148 people account for 47%, while the rest of population are Gelao (33%), Miao (14%), and Han
149 people (6%) (Zhu *et al.* 2017). MNNR is home to the largest free-ranging population (about
150 554 individuals) of François' langurs in the world and the survival of the langurs in this
151 reserve is key for the conservation of this species (Niu *et al.* 2016).



152

153

Fig. 1 Qinglong Village and Mayanghe National Nature Reserve in China

154

155 Human-langur interactions are common in MNNR. Due to the dense human population

156 and the severe degradation of natural habitats in the reserve, the langurs have been observed

157 to feed on cultivated plants (e.g. corn and sweet potato) and forage in homes, causing

158 considerable crop and property damage (Niu *et al.* 2016). Local youths injured three langurs

159 to prevent crop damage in 2011 and one langur was killed by a dog in 2013 (Niu *et al.* 2016;

160 Zhu *et al.* 2017). To address the complaints of local residents concerning property damage

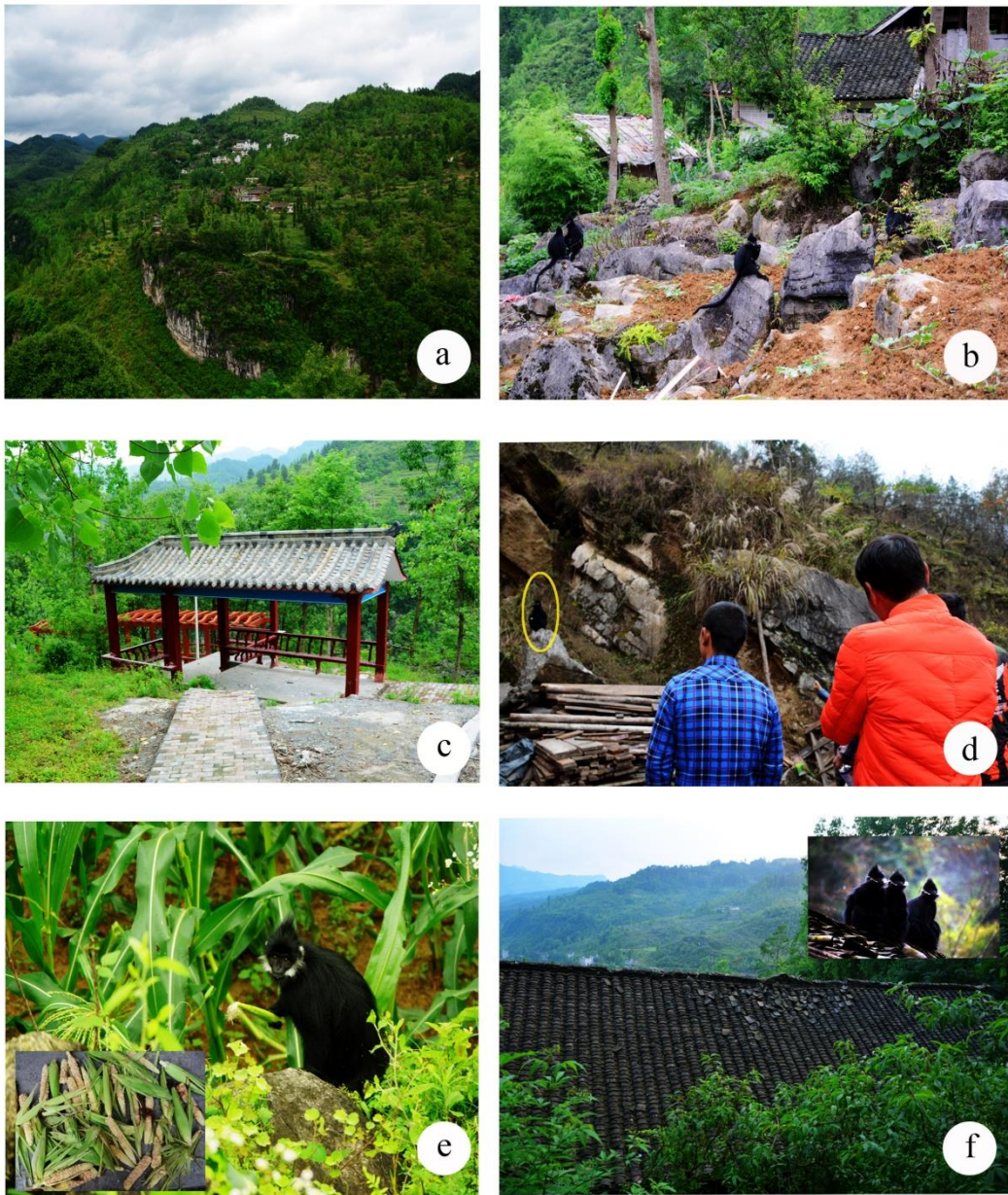
161 caused by langurs, the reserve administration began to financially compensate local residents

162 for economic losses in 2011.

163 Local residents are heavily dependent on natural resources. The majority of natural
164 resources (timber and nontimber forest products, hunting, fishing, and mining) in the reserve
165 are strictly for household use or commercial sale. The limited access to natural resources
166 brings considerable opportunity costs (i.e., potential benefits to people that are lost to protect
167 a site for the langur population) to the local community (Barua *et al.* 2013; Hvenegaard 2014).
168 Human disturbance, including illegal activities, still occurs in the reserve (Zhu *et al.* 2017). In
169 2014-2015, up to 40 ha of forest were illegally logged (data from MNNR). Until recently,
170 snares could easily be bought in a nearby market in Huangtu town (Zhu *et al.* 2017). Wild
171 boar (*Sus scrofa*) and tufted deer (*Elaphodus cephalophus*) have been hunted in the past five
172 years (Author, unpubl data; Zhu *et al.* 2017).

173 Our study site is Qinglong village in the south of MNNR (Fig. 1 and Fig. 2 a). It is
174 an agricultural village and people plant a variety of cash crops including corn, tobacco, sweet
175 potato, bean, potato, and vegetables (Author, unpubl data). The main grazing animals are
176 cattle, goats, pigs and chickens (Author, unpubl data). At least three groups of François'
177 langurs (32 individuals in total) were observed around this village in 2015 (Fig. 2 b, Author,
178 unpubl data). We selected Qinglong village because it has been a site of several pilot
179 conservation programs and provides a model system to study the relationship between local
180 residents and François' langurs. Beginning in 1997, the MNNR staff habituated a group of
181 François' langurs in Qinglong village through food provisioning with the permission of
182 MNNR administration to study François' langur ecology and develop tourism (Wu 2004).
183 From this point on, more and more tourists come to this village to watch langur. For example,

184 about 900 tourists visited the area per day during the National Celebration Day Holiday
185 (October 1-5) in 2016 (Data from MNNR). However, as langur tourism developed without
186 strict guidelines in the village, people often interact with and feed monkeys. Qinglong village
187 is supported by the local county government and MNNR administration to develop a François'
188 langur tourism program; at least 3 million CNY (~ US\$ 450,000) has been invested in the
189 construction of infrastructure such as roads, walking paths and a public square in the village
190 since 2011 (Fig. 1). This construction near the river valley may have caused habitat loss for
191 François' langurs in Qinglong village (Niu *et al.* 2016).



192

193 Fig. 2 a A corner of Qinglong Village in **Mayanghe National Nature Reserve**, China; b François' langurs in Qinglong
 194 Village; c New infrastructure construction in Qinglong village because of the langur-related tourism program; d Local
 195 residents and tourists watching François' langurs; e François' langurs feeding on **maize crops**; f A house damaged by
 196 François' langurs. (Photo: a-d, f by XXX and e by XXX).

197

198 **Questionnaire design and sampling**

199 We sampled one adult (>18 years old) per household. Only 110 of 232 households
200 were occupied in the village because over half of the residents were working in the cities
201 during most of the year. This phenomenon may bias our results (Knight 1999; Kansky *et al.*
202 2014). Through an online sample size calculator (<http://www.surveysystem.com/sscalc.htm>),
203 combining confidence interval (also called margin of error; expressed as decimal, e.g., 0.05
204 = ± 5) and 95% confidence level (The 95% confidence level means we are 95% sure that the
205 true percentage of the population who would pick an answer lies within the confidence
206 interval), we determined that a sample size of 86 households would provide a representative
207 sample of the current population in Qinglong village. To obtain this sample size, we tried to
208 interview all the households who were available in the village during our study period.

209 Before we designed the questionnaire, we conducted a pre-interview field visit in
210 December 2014 with two MNNR staff and three local people to gain a locally informed
211 understanding of the positive and negative aspects of MNNR and François' langurs.
212 Subsequently, we designed a questionnaire that included four parts: 1) socio-demographic
213 information and local beliefs about animals, 2) agricultural income (mainly income generated
214 from crops, livestock and governmental subsidies) and land use, 3) local people's knowledge
215 of MNNR, François' langurs, and views about wildlife crop-feeding, damage and remedies,
216 and 4) local people's perceptions of and attitudes toward François' langurs and MNNR.

217

218 **Data collection**

219 From March to August 2015, we conducted household interviews following a

220 questionnaire containing structured, semi-structured, and open-ended questions (Dore *et al.*
221 2018b). We interviewed a total of 105 adults. We could not complete all the questions for all
222 respondents due to medical conditions (e.g. deafness), time limitations and some respondents'
223 low desire to participate. Although the local dialect is similar to Mandarin, we hired a local
224 interpreter/facilitator to overcome language and cultural barriers (Ellwanger *et al.* 2017). This
225 person was not affiliated in any way with the local authorities of Qinglong village or the
226 MNMR administration; to our knowledge, his presence did not have any significant influence
227 on the answers given by the respondents during the interviews.

228 In attitudinal questions, we used the term “like” (Do you like the François' langur
229 living around your village?) to assess a respondent's degree of positive attitude toward the
230 François' langur (Ajzen and Fishbein 1980; Allendorf 2007; De Boer and Baquete 1998). We
231 divided respondents' answers into positive (like), neutral, and negative (dislike) responses
232 plus unsure. Participants also shared their reasons for selecting their answers.

233 We also designed ten questions to assess the costs and benefits respondents
234 associated with the langurs in terms of specific interactions between human and langur in **the**
235 local context (e.g., the impact of langur related tourism) (Barua *et al.* 2013; Kansky and
236 Knight 2014). We used a 5-point Likert scale to evaluate the degree of costs and benefits in
237 each question: very important benefits, important benefits, no significant benefits or costs
238 from langurs, important costs, and very important costs. We also recorded participants'
239 comments on the types of cost or benefit **associated with** langurs.

240

241 **Data analysis**

242 **Attitudinal analyses**

243 We calculated the percentage of respondents ($N = 75$) that expressed each attitude
244 type. We used open coding to analyze the open-ended comments in response to attitude
245 questions (Bernard and Ryan 1998; De Boer and Baquete 1998; Ellwanger *et al.* 2015). We
246 identified specific themes that emerged from interviews with regards to respondent attitudes
247 and created “reason” codes. We grouped these codes by similarity into “reason types” and
248 then classified these reason types into four categories of perceived costs and benefits: tangible
249 benefits, tangible costs, intangible benefits and intangible costs. For conceptual clarity and
250 category definitions, we referred to Kansky and Knight (2014).

251 To understand the importance of each reason type and cost and benefit category in
252 explaining differing attitudes towards the langurs among respondents, we calculated the
253 frequency and percentage of each reason type and category among positive, neutral, negative
254 attitudes and effective number of respondents.

255

256 **Perceived costs and benefits of langurs**

257 Similar to Carter *et al.* (2014), we consolidated the respondents’ responses to cost
258 and benefit questions from a five-point scale to a three-point scale: positive perception
259 included very important benefits and important benefits (coded “1”), neutral responses
260 included no strong impact from langurs (coded “0”), negative responses included important
261 costs and very important costs (coded “-1”). We coded unsure answers as “NA”. We
262 calculated the percentage of respondents that perceived benefits and costs related to the

263 François' langurs. We created an aggregate score based on the ten questions assessing
264 respondent perceptions of cost and benefit and assigned a score to each respondent based on
265 their responses. We then divided these questions into two groups to assess respondent
266 perceptions of costs and benefits relating to the François' langurs at the household level and at
267 the community level.

268

269 **Key factors driving attitudes toward François' langurs**

270 To further examine the effect of various factors on local people's attitudes towards
271 langurs, we ran an ordinal logistic regression with attitudes at three levels (positive, neutral,
272 and negative).

$$273 \text{ Logit } [P (\textit{Attitudes} \leq j|X)] = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

274 The probability of an attitudinal category can be expressed as $P (\textit{Attitudes} \leq j|X)$ where X is
275 the explanatory variable; α_j is the intercept; and $\beta_n = \beta_1, \beta_2, \dots, \beta_n$ are regression coefficients.

276 The independent variables included:

277 *Age*: how old the respondent is;

278 *Gender*: female = 0, male = 1;

279 *Education*: how long the respondent received formal education;

280 *Household perception*: the mean score for cost and benefit perception at the household level;

281 *Community perception*: the mean score for cost and benefit perception at the community
282 level;

283 *Income*: ln (the household income of the respondent in one year).

284 To test collinearity among independent variables, we calculated the variance

285 inflation factors (VIFs), where VIFs < 4 implies absence of collinearity (O'Brien 2007).
286 Model 1 included all above independent variables, while “*income*” was excluded in Model 2.
287 The sample size was smaller for Model 1 ($N = 63$) than for Model 2 ($N = 75$) because 12
288 respondents did not report their income clearly.

289 We set alpha at 0.05. We entered and coded data using MS Excel and conducted
290 statistical analysis using SPSS 20.0 software.

291

292 **Ethical note**

293 We collected data in accordance with the legal requirements of People’s Republic of
294 China, and with the permission of the Guizhou Forestry Department, Mayanghe National
295 Nature Reserve Administration, and Qinglong village Committee. We read each interviewee a
296 statement explaining the scientific purpose of our survey and requested and obtained their
297 permission to participate in the interview process, including their permission to audio record
298 the interview.

299

300 **RESULTS**

301 **Socio-demographic information**

302 We obtained socio-demographic information for 105 households in Qinglong
303 village (Table 1). 502 residents, including 261 males and 241 females, lived in the 105
304 households. The mean household size was $5 \pm SD 2$ people. The mean age of 105

305 respondents was $48 \pm \text{SD } 15$ years old. Although Tujia people only account for 47% of the
 306 population in MNNR, all respondents in this study were Tujia people. Overall, the education
 307 level in the community was low and the mean annual income of each household was about
 308 32,359 CNY (~ US\$ 5,123) in 2014.

309

310 **Table 1 Socio-demographic composition of all respondents and those who finished the**
 311 **survey in Qinglong village, Mayanghe National Nature Reserve, China, March to**
 312 **August 2015**

Demographic Variables	Mean \pm SD		% (number) of respondents	
	All ^a	Finished the survey ^b	All ^a	Finished the survey ^b
Age	48 \pm 15 (105)	48 \pm 14 (75)		
Gender				
Male			59 (62)	67 (50)
Female			41 (43)	33 (25)
Family size	5 \pm 2 (105)	5 \pm 2 (75)		
Education				
None			35 (37)	29 (22)
Primary school (1-6 years)			31 (32)	32 (24)
Middle school (6-9 years)			27 (28)	28 (21)
Higher level (> 9 years)			8 (8)	11 (8)
Annual Income in 2014^c (CNY)	32359 \pm 35269 (91)	32791 \pm 35039 (63)		

^a Including all households who finished the description of socio-demographic factors in the questionnaire ($N = 105$).

^b Including all households who finished both the description of socio-demographic factors and questions about attitudes and perceptions ($N = 75$).

^c Effective sample size (not all households reported annual income: $N = 91$ or $N = 63$).

313

314 30 respondents did not complete the interview, so the sample size for local people's
 315 perceptions of and attitudes towards langurs was 75. In general, the socio-demographic

316 information of these 75 respondents was similar to those of the 105 total respondents, except
 317 for their gender (Table 1). Only one third of respondents ($N = 75$) were female due to
 318 limitations on time and the lower desire to participate by local women.

319

320 Attitudes towards langurs

321 Of the 75 respondents, 40 (53%) said they liked the fact that the langurs are in
 322 their village; 20 (27%) responded negatively and 15 (20%) were neutral. Nine respondents
 323 did not clearly articulate the reasons for their responses; thus, the sample size was 66
 324 respondents for the analysis of their reasons. We identified 15 (sub)themes in the data (Table
 325 2).

326

327 **Table 2 Frequency (%) of each reason type mentioned for attitudes towards langurs**
 328 **among respondents in Qinglong village in Mayanghe National Nature Reserve, China,**
 329 **March to August 2015**

Category of perceived cost and benefit ^a	Reason types and key description of the answers (original in Chinese)	Positive attitude $N=33$	Negative attitude $N=19$	Neutral attitude $N=14$	Total ^b $N=66$
Tangible Benefits: Those where the respondent receives direct monetary benefits due to the presence of the species on their land: hunting fees or hunting for meat, langurs tourism, financial compensation programs, development projects (e.g. infrastructure building), subsidies for implementing mitigation measure, or reputation.	1. Langurs bring "luck", improve personal income (享猴子的“福”或个人致富), attract investments (带来资金)	11 (33%)	0 (0%)	1 (7%)	12 (18%)
	2. Attracting tourists, making their village a bustling place (带来游客, 闹热, 外来人会来玩)	5 (15%)	0 (0%)	3 (21%)	8 (12%)
	3. More infrastructures and/or better roads, etc. (搞建设, 修路等)	4 (12%)	0 (0%)	1 (7%)	5 (8%)
	4. International recognition, media attention, proud of François' langur (国际重视或外来人知道, 村子因为黑叶猴可以上电视, 以黑叶猴为傲)	3 (9%)	0 (0%)	1 (7%)	4 (6%)
	5. Direct financial compensation for crops losses (农作物损失经济补偿)	0 (0%)	0 (0%)	2 (14%)	2 (3%)
Intangible Benefits: Indirect benefits as perceived by the respondent, such as positive aesthetic/emotional/cultural value or	6. Lovable (可爱)	5 (15%)	0 (0%)	1 (7%)	6 (9%)
	7. Humans and animals have a close relationship in	1	0	0	1

ecosystem services of species (e.g. environmental quality, education).	general (人与动物有密切的关系)	(3%)	(0%)	(0%)	(2%)
	8. Beautiful, acrobatic, with graceful postures (好看, 飞跳美观, 姿势优美)	7 (21%)	0 (0%)	1 (7%)	8 (12%)
	9. Good or funny to play with (好玩, 好耍)	7 (21%)	0 (0%)	1 (7%)	8 (12%)
	10. Improving environment (提升环境质量)	1 (3%)	0 (0%)	0 (0%)	1 (2%)
Tangible Costs: Those where the respondent suffers direct monetary losses due to the presence of the species on their land. For instance, economical income losses such as crop or fruit loss, house damage by langurs.					
	11. Conflicts; troublemaking animal (猴子生活到这个地方, 自己就生活不下去; 害兽, 讨嫌)	0 (0%)	6 (32%)	1 (7%)	7 (11%)
	12. Crop (corn) feeding (吃庄稼或吃玉米(苞谷))	2 (6%)	11 (58%)	8 (57%)	21 (32%)
	13. Ransacking houses, damaging property and stealing food (破坏房子, 翻房子, 进房子偷东西)	0 (0%)	5 (27%)	5 (36%)	10 (15%)
	14. Eats fruits (吃果实)	0 (0%)	1 (5%)	0 (0%)	1 (2%)
Intangible Costs: Indirect cost as perceived by the respondent, such as individual psychological costs of fear, danger from species, negative aesthetic/cultural value as well as negative health impact, opportunity and transaction costs.					
	Not available	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Neither costs nor benefits					
		0 (0%)	0 (0%)	3 (21%)	3 (5%)
	15. National protected animals (国家保护动物)	0 (0%)	0 (0%)	2 (14%)	2 (3%)

330 ^a For conceptual clarity and categories of specific reasons in this paper, we referred to Kansky and Knight (2014) and the local context.

331 ^b Effective number of respondents equals 66. Respondents sometimes gave multiple reason types in a response, so total frequencies may
332 be higher than the number of respondents.

333

334 33 respondents clearly articulated the reasons for their positive responses. Those who
335 held favorable attitudes concerning living near the langurs mainly described tangible
336 benefits and intangible benefits (Table 2). The most important tangible benefits related to
337 langur tourism, and the most important intangible benefits related to cultural perceptions
338 such as aesthetic value and emotional connection to the langurs (Table 2).

339 Some respondents explained that langurs bring “income” or “luck (luck or 福,
340 “economic income” in the local dialect)” and “investment”. As one respondent commented

341 “when monkeys become more, the village becomes richer and our area develops”. One
342 senior respondent even said, “we are getting good luck from langurs. If there were no
343 monkeys in our village, some young men here would not be able to find a wife”. Another
344 respondent thought the existence of langurs can bring some other “economic benefits and
345 development”. As one respondent said, “the existence of langurs brings very limited income
346 for my families, but it brings much more benefits to our area”. These reasons were mainly
347 divided into three types: attraction for tourists (e.g. “the visitors from outside come (to our
348 village) because of the langurs”), infrastructure construction for tourism (e.g. “if no
349 monkeys, the road here cannot be built better”), and the reputation of the place (e.g. “our
350 village is getting more famous”, “our area was shown on TV”, “we are proud of the langur”)
351 (Table 2 and Fig. 2 c-d).

352 Local people enjoyed seeing François' langurs (Table 2). For instance, a few
353 respondents described the reasons why they liked the langurs: “langur is a beautiful animal”,
354 “graceful jumping postures of monkeys”, “when monkeys jumped on the trees, they are
355 more beautiful than a dance”. Emotional responses (“langur is a lovable animal”) and
356 cultural interactions such as “good or fun to play with” are also important reasons to shape
357 local positive attitudes towards the langurs. Two respondents felt that crop feeding by
358 langurs was not serious and they still had a positive attitude to the langurs. One respondent
359 said “(the langurs) just fed on little crops, no big deal. They benefit us”, while the other one
360 thought the “monkey can bring us luck. Although they feed on crops, they are still good for
361 us”. In addition, one respondent claimed that the intangible benefits have the potential to
362 turn into tangible benefits. She liked langurs because they are beautiful but went on to say

363 that “people from outside need to spend money to come here and watch them”.

364 Only one negative respondent was unable to clearly articulate the reason for her
365 response. Negative attitudes primarily related to tangible costs of the langurs’ presence such
366 as crop or fruit feeding, destruction of house and property, or negative interactions between
367 people and langurs (Table 2, Fig. 2 e-f). Some respondents said that they disliked the langurs
368 because langurs fed on their corn and one respondent complained that “I worked so hard for
369 my crops. However, the langurs can eat the crop and nobody provides financial
370 compensation for my economic losses”. Other human-langur interactions (e.g. damaging
371 house, fruit feeding) also shape local attitudes in Qinglong village. A few respondents said,
372 “langurs are hateful because they can damage our house and enter our house to search for
373 food”. The strongest expression from one respondent was that “I cannot survive here
374 because of the existence of these langurs here”.

375 Of neutral respondents, one was unable to articulate the reason for her response.
376 Over half of neutral respondents claimed that the presence of langurs in the village resulted
377 in a trade-off with good and bad aspects ($N = 9$). For instance, one respondent said, “I like
378 the langur because the langurs can attract the tourists to visit our village and I can get some
379 economic benefit from this. I dislike them because they feed on my crops.” Another
380 respondent told us: “I like the langurs because these animals are beautiful while I dislike
381 them because they feed on my crops and damaged my house”. One of respondents
382 connected her attitude with local financial compensation. She said that “I would like the
383 langurs if my economic losses were compensated; otherwise, I dislike the langurs.” Three
384 other respondents thought that there were neither costs nor benefits of co-existing with

385 langurs. Two men said “I like the langurs because these animals are listed as national
 386 protected animals while I hate them because they feed on my crops”.

387 **Local perceptions of costs and benefits**

388 Overall, the mean score for respondent perceptions of costs and benefits of living
 389 nearby the langurs is neutral ($0.1 \pm$ SD 0.2, $N = 75$). The mean perception of costs and
 390 benefits of langurs at the household level (Table 3, FL1, FL4, FL6-FL9) was slightly
 391 negative ($-0.3 \pm$ SD 0.3, $N = 75$) while at the community level (Table 3, FL2, FL3, FL5, FL10)
 392 it was positive ($0.7 \pm$ SD 0.3, $N = 75$). The most important benefits associated with the
 393 langurs included the reputation of their village the development of local tourism and the
 394 development of local infrastructure (Table 3). The most important costs associated with the
 395 langurs’ presence included the impact on tree cutting in the mountain, personal economic
 396 income, and use of wildlife resources (e.g. hunting) in the forest (Table 3).

397

398 **Table 3 Perceived benefits and costs of François’ langurs (FL), Qinglong village,**
 399 **Mayanghe National Nature Reserve, China, March to August 2015**

Code	Question in terms of specific interactions between human and langur in local context	Positive	Negative	Neutral	Unsure
FL1	Does the FL have any impact on your economic income?	4%	49%	44 %	3%
FL4	Does the FL have any impact on the education of your next generation?	16%	5%	59%	20%
FL6	Does the FL have any impact on tree cutting in the mountain of your village?	5%	55%	32%	8%
FL7	Does the FL have any impact on your use of wildlife resource (e.g. hunting) from the forest?	3%	41%	51%	5%
FL8	Does the FL have any impact on mining activities in the mountains around your village?	1%	37%	27%	35%
FL9	Does the FL have any impact on grazing around your village?	7%	8%	72%	13%
FL2	Does the FL have any impact on the environment of your village?	9%	4%	63%	24%
FL3	Does the FL have any impact on the reputation of your village?	88%	0%	3%	9%
FL5	Does the FL have any impact on the development of local	76%	3%	12%	9%

infrastructure?

FL10 Does the FL have any impact on the development of local tourism? 80% 1% 8 % 11%

400

401 **Key predictors of attitudes towards the langurs**

402 Model 1 (with factor *income*) showed the same significant factors as Model 2
403 (without factor *income*). Respondents' perceptions of the costs and benefits of co-existing
404 with langurs at the household or community level, age and gender were significantly
405 associated with attitudes towards langurs while education level did not predict local attitudes
406 in either model (Table 4). Model 1 also showed that *income* was not a significant predictor
407 of local response. We focus on Model 2 due to the larger sample size.

408

Table 4 Variables shaping respondents' attitudes to François' langurs in an ordinal regression model, Qinglong village, Mayanghe National Nature Reserve, China, March to August 2015

Variable	Model 1				Model 2			
	(with income, N=63)				(without income, N=75)			
	Estimate	Standard	Odds	P	Estimate	Standard	Odds	P
	(b)	Error	Ratio		(b)	Error	Ratio	
age	-0.07	0.03	0.94	0.025	-0.09	0.03	0.92	0.001
income	0.20	0.25	1.22	0.418				
household perception	3.36	1.14	28.82	0.003	3.80	1.10	44.70	0.001
community perception	2.50	1.15	12.20	0.030	2.50	0.99	12.15	0.011
education	-0.09	0.34	0.91	0.793	0.01	0.33	1.01	0.977
gender=0 (1 = reference)	-1.81	0.69	0.16	0.009	-1.68	0.65	0.19	0.010

Note: -2 Log Likelihood = 100.5, $\chi^2 = 28.1$, df = 6, P = 0.000, Nagelkerke Pseudo R-Square = 0.41 Note: -2 Log Likelihood = 117.1, $\chi^2 = 34.3$, df = 5, P = 0.000, Nagelkerke Pseudo R-Square = 0.42

409

410 The ordinal logit model showed that, when keeping all other independent variables
411 constant, the household level perception of the costs and benefits of langurs was

412 significantly associated with local residents' attitudes toward langurs; for one unit increase
413 (i.e., going from 0 to 1) in the mean score for cost and benefit perception at the household
414 level, the odds of positive attitude were 44.7 times greater than the combined negative and
415 neutral categories (Table 4). Likewise, the langurs' impacts on cost and benefit perceptions
416 at the community level were also significantly associated with local residents' attitudes
417 toward langurs; for one unit increase in the mean score for cost and benefit perception at the
418 community level, the odds of positive attitude were 12.15 times greater than the combined
419 negative and neutral categories, when we held the other variables in the model constant. In
420 general, perceived benefit at household or community levels increased the likelihood of
421 local people having a positive attitude toward langurs. *Age* was also significantly associated
422 with local residents' attitudes toward langurs. As the age of respondent increased by one year,
423 the probability of having a more positive attitude toward langurs decreased by 8%, after
424 controlling for the effects of other variables in the model. *Gender* was significantly
425 associated with local residents' attitudes to langurs; for women the odds of having a more
426 positive attitude toward the langurs were lower by 81% than for men, holding other
427 variables in the model constant.

428

429 **DISCUSSION**

430 Overall, our results suggest that perceived costs and benefits explained local
431 people's attitudes toward François' langurs well. Higher perceived benefits were associated
432 with a more positive local attitude towards the langurs while higher perceived costs were

433 associated with more negative attitudes. The results are similar to those in previous studies in
434 that perceived costs and benefits are the main drivers of attitudes (e.g., Kansky and Knight
435 2014; McLennan and Hill 2013). The results also showed that the perceived benefits and costs
436 associated with langurs at the household level tended to be negative overall while those at the
437 community level these perceptions were quite positive. This difference in positive and
438 negative responses at the community and household levels appears to be a common pattern
439 (Khatun *et al.* 2012; McLennan and Hill 2013; Sousa *et al.* 2014; Hardwick *et al.* 2017). For
440 example, researchers found that local people regarded chimpanzees (*Pan troglodytes*) as a
441 good “crop raider” at Bulindi in Uganda and Cantanhez National Park in Guinea-Bissau since
442 they play both a positive (flagship for tourism) and a negative (crop feeding) role in the
443 livelihoods of local people (McLennan and Hill 2013; Sousa *et al.* 2014).

444

445 **Key costs of living with the langurs and attitudes towards the langurs**

446 The costs of living with a species are important in explaining attitudes towards large
447 mammals (Kansky and Knight 2014). However, the relative importance of the four
448 sub-categories of costs and benefits likely vary across different animal species. Intangible
449 costs (i.e., fear) of living with species perceived to be dangerous may be more important than
450 other factors in shaping people’s attitudes towards large mammals (Kansky and Knight 2014).
451 In our study, intangible costs were not a strong predictor of local attitudes toward François'
452 langurs. This could be because langurs are less aggressive than the larger mammals in other
453 studies (Campbell-Smith *et al.* 2010; Hockings *et al.* 2010; Kansky and Knight 2014).

454 Meanwhile, the intangible opportunity costs of living with damage-causing wildlife also
455 influence wildlife conservation (Barua *et al.* 2013). In this study, tree cutting in the mountain,
456 personal economic income, and use of wildlife resources in the forest were three important
457 perceived costs that local people associated with langurs at the household level. However,
458 these negative perceptions appeared to explain local attitudes toward langurs unevenly. No
459 respondent mentioned opportunity costs relating to wood and wildlife resources as reasons for
460 their attitudes towards langurs.

461 We found that langur crop-feeding related to personal economic income (Tangible
462 Costs) is the top factor explaining the negative attitude of local people towards langurs in
463 Qinglong village. This result is not surprising. Local residents' economic losses from
464 crop-feeding can detract from the community support of species conservation. Crop-feeding
465 by primates causes negative interactions between primates and local people in many areas
466 (e.g. Hill 2000, 2005; Khatun *et al.* 2013; Lee and Priston 2005; McLennan and Hill 2013;
467 Sousa *et al.* 2014). We also found that property destruction caused by langurs and simply
468 living in the same area as langurs were linked to negative attitudes in Qinglong village.
469 Crop-feeding, houses and property destruction were most likely to cause respondents'
470 household economic losses, and were linked to negative perceptions and attitudes of local
471 residents.

472 Two respondents felt that crop feeding by langurs was not serious as they only fed
473 on crops with a low economic value. Economic losses such as crop-feeding by some primate
474 species are not always a significant factor driving negative sentiments in local farmers
475 (Khatun *et al.* 2012; Radhakrishna 2017). Different levels of crop damage lead to varied

476 attitudes to langur in local people.

477

478 **Benefits of living with the langurs and attitudes towards the langurs**

479 We found that the cost and benefit perceptions of living with the langurs at the
480 community level is very positively and significantly related to local peoples' attitudes towards
481 the langurs. Among these perceptions, the impact of langurs on the development of local
482 tourism (Tangible Benefits) has the most important potential. 80% of the respondents thought
483 the existence of langurs is good for local tourism development. Langur-related tourism has
484 multiple benefits in Qinglong village, including bolstering the local economy and improving
485 village reputation and infrastructure. This is similar to previous studies that suggest local
486 tourism associated with flagship wildlife species positively affected local attitudes toward
487 wildlife (Sekhar 2003; Waylen *et al.* 2009; Khatun *et al.* 2012; Sousa *et al.* 2014). In
488 particular, primate tourism has delivered measurable economic benefits, funding for
489 conservation activities, improved agricultural markets, and likely improved attitudes towards
490 conservation in some countries (e.g. Uganda, Hvenegaard 2014; Uganda, McLennan and Hill
491 2013; Guinea-Bissau, Sousa *et al.* 2014; China, Xiang *et al.* 2011). Kansky and Knight (2014)
492 suggested that tangible benefits may be more important in explaining attitudes towards
493 species that generate larger contributions to livelihoods. The human-langur relationship may
494 be improved through tangible benefit sharing such as public investment in the local
495 community and species related-tourism development. Caution, however, is required, as
496 tourism infrastructure can contribute to the destruction and fragmentation of the langurs'

497 habitat. MNNR administration should work with local governments to minimize the impact of
498 infrastructure construction (Fyumagwa *et al.* 2013).

499 While some studies have shown a positive association between wildlife tourism and
500 attitudes, some researchers argue that it may not result in positive conservation behaviors
501 toward wildlife (e.g. Sekhar 2003; Waylen *et al.* 2009) and may even contribute to
502 socio-ecological problems that further harm conservation efforts (Desmond and Desmond
503 2014; Liu *et al.* 2012, 2016; Russon and Susilo 2014; Russon and Wallis 2014). For example,
504 the relationship between local residents and protected area and tourism management bodies
505 may change as tourism develops (Liu *et al.* 2016). Local people might be positive at the early
506 stage of local tourism development since they have obtained or seen some benefits (Ellwanger
507 *et al.* 2015; Xu *et al.* 2006, 2009); but as tourism develops, local residents often benefit from
508 tourism disproportionately, with the poorer benefiting less, such as in the Wolong National
509 Nature Reserve (Liu *et al.* 2012, 2016; Sekhar 2003; Xu *et al.* 2006, 2009). In the case of
510 MNNR, although the majority of Qinglong village residents have not yet received significant
511 economic benefits from langur-related tourism, local people perceived the existence of
512 langurs as a major attraction and thus had high expectations of future tourism development
513 (and potential benefit). However, this high expectation may lead to a higher management risk
514 if it cannot be met in the near future. Only a small proportion of local population can benefit
515 directly from ecotourism (Liu *et al.* 2016). The lack of direct participation or the unequal
516 distribution of economic benefits in the long run may result in negative attitudes toward the
517 nature reserve (Hvenegaard 2014; Xu *et al.* 2006; Liu *et al.* 2016). In our study, we found that
518 only 4% of residents claimed that they currently benefited economically because of the

519 existence of the langurs. This point might be explained by the current development of local
520 tourism in Qinglong village. Although more and more tourists came to this village for langur
521 watching, these visitors had free to access Qinglong village and most spent just half a day
522 watching the langurs then drove to the city for lodging and food (author's personal
523 observation). Thus, their expenditure in Qinglong village was very limited. Local investments
524 in the tourism industry are limited because of the low financial capacity of local residents.
525 Future policy should combine the goal of species conservation and poverty alleviation, for
526 example by providing training in tourism services to local people. Meanwhile, similar to
527 guidelines for best practice in great ape tourism (Williamson and Macfie 2014), the
528 government and local community can consider developing langur-watching ecotourism
529 guidelines in a responsible way to ensure a better balance between species conservation and
530 local economic development.

531 In addition to the benefits of langur-related tourism, intangible benefits such as
532 positive emotions and aesthetic values might positively influence the relationship between
533 humans and langurs. Intangible benefits may be more important for species that are
534 particularly attractive or have high symbolic importance (Kansky and Knight 2014).
535 Adjectives such as “beautiful” were used to describe the langurs. Similarly, in Tombali, south
536 of Guinea-Bissau, aesthetic values (i.e. pretty or ugly) can be key components in determining
537 people's attitude toward Guinea baboons (*Papio papio*) (Costa *et al.* 2013). Moreover, local
538 residents also used “loveable” and “good or funny to play with” to describe interactions
539 between human and langurs in our study. This suggests that local residents have a good
540 emotional disposition toward François' langur, which can be an important factor in people's

541 response to wildlife (Jacobs *et al.* 2012). This positive emotional disposition toward the
542 langurs may have its roots in traditional Chinese culture (Jacobs *et al.* 2012; Cui *et al.* 2012;
543 Kansky and Knight 2014; Zhang 2015). The Chinese believe that both people and monkeys
544 benefit from interacting which results in harmony (Chang 2001). In this case, a “good”
545 emotional disposition supports positive local attitudes towards the François' langur. Future
546 research on aesthetic and emotional interactions between humans and langurs would help to
547 better understand the influence of intangible benefits on local attitudes in MNNR.
548 Simultaneously, interactive with langurs has a potential risk of anthroponotic disease
549 transmission from human to langurs (Wallis and Lee 1999; Muehlenbein and Wallis 2014).

550

551 **Trade-off between costs and benefits and attitudes towards the langur**

552 We found a trade-off between costs and benefits shaping local attitudes toward langurs.
553 On the one hand, some respondents viewed a trade-off between tangible benefits and
554 tangible costs. For instance, one respondent liked the langurs because they can attract
555 tourists to visit the village and lead to economic benefits; however, she disliked them
556 because they fed on her crops. Previous studies have also linked tangible costs and benefits
557 to explain local attitudes toward species (Khatun *et al.* 2012; McLennan and Hill 2013;
558 Sousa *et al.* 2014). Sousa and colleagues (2014) considered that local perceptions of
559 chimpanzees might be driven by not only crop feeding but also by the benefits of species
560 tourism. In addition, direct financial compensation may play be a positive influence on local
561 attitudes to species. However, only few respondents mentioned that direct financial
562 compensation influenced their attitudes and one respondent complained that there is no

563 compensation for crop losses. Therefore, direct financial compensation seems not to be an
564 efficient or effective mean to counteract loss to influence local attitudes. Scientific
565 evaluations of property losses and effective practices of financial compensation (e.g.
566 sustainable financial source for compensation, transparent compensation policy, and timely
567 payment for losses) should be conducted to reduce institutional vulnerabilities related to
568 financial compensation (Setchell *et al.* 2017).

569 On the other hand, we found a trade-off between intangible benefits and tangible
570 costs. Although we did not examine this quantitatively, our analysis showed that intangible
571 benefits appeared to have an effect on local attitudes. While people favored the langurs due to
572 their beauty, they disliked langurs because they fed on crops and damaged houses. This
573 trade-off also appeared to be an important facet of local attitudes toward primates in previous
574 studies (Costa *et al.* 2013; Lee and Priston 2005; Hill and Webber 2010; Sousa *et al.* 2014).
575 For instance, several other studies have found that the human-like appearance and behavior of
576 some primate species can contribute to positive attitudes, while crop-raiding makes people
577 perceive animals as pests (Costa *et al.* 2013; Dore *et al.* 2018a; Hill and Webber 2010).

578

579 **Key demographic factors and attitudes towards the langurs**

580 Demographic factors such as age and gender may influence attitudes toward
581 wildlife both positively and negatively, depending on the cultural and historical context and
582 the knowledge or experiences of these respective groups (e.g. Ellwanger *et al.* 2015; Kansky
583 and Knight 2014; McLennan and Hill 2013; Sousa *et al.* 2014). For example, adults

584 emphasized chimpanzee behavior and narratives about the shared history of humans and
585 chimpanzees while young people emphasized morphological aspects of human-chimpanzee
586 similarities in a study of human-chimpanzee relations (Sousa *et al.* 2014). In our case, the
587 relationship between age and attitude toward langurs might stem from different historical
588 experiences of langurs in older and younger people. The extent to which a person has
589 interacted with a species is likely to be an important predictor of attitudes towards a species
590 (Kansky and Knight 2014). According to one respondent, “before the reserved was
591 established (1987); the langurs could be caught and sold. The price was up to 500 CNY (~
592 US\$ 80) per individual.” Hunting might have been an important income source for some local
593 people in the past. However, the law forbade langur hunting when reserve was created. Since
594 then, the langurs have brought no direct economic benefits for those older residents. In
595 contrast, the improvement of infrastructure and tourist attractions due to the development of
596 langur-related tourism make it convenient for younger people to go to cities for work and
597 brings opportunities to earn money in their village. Older people also have fewer income
598 sources than younger people. Younger people prefer to go to the cities to earn money while
599 older people might depend more on planting crops. After the langurs were protected and
600 habituated to humans, they occurred near the village and fed on crops more frequently than
601 before. This would bring relatively higher economic losses (crop feeding and property losses)
602 and negative perceptions for older farmers, although we did not identify a direct and
603 significant effect of local income level on local attitude.

604 Men’s attitudes toward langurs in this study were more positive than those of
605 women. This result is very similar to several studies in Myanmar and China (Allendorf and

606 Allendorf 2013; Allendorf and Yang 2015). Researchers found that men are more likely to
607 have a positive attitude toward protected areas and to perceive conservation and ecosystem
608 service benefits than women and that gender differences in knowledge about the reserve
609 contributed to the understanding of gendered perceptions of problems and benefits of the
610 reserve (Allendorf and Allendorf 2013). In our case, local people's knowledge of the benefits
611 of François' langurs in MNNR can be considered as knowledge of species ecosystem services
612 and men might be more knowledgeable about these benefits due to their greater involvement
613 in local management information communication in male-led households. A similar
614 phenomenon has been described elsewhere in China (Allendorf and Yang 2015; Xu *et al.*
615 2006). Local women might be more familiar about a species' ecology since it seems that more
616 females take care of farmland in the village (author's personal observation). Women are also
617 more knowledgeable about the Guizhou snub-nosed monkeys (*Rhinopithecus brelichi*) than
618 men in Fanjingshan National Nature Reserve in China (Ellwanger *et al.* 2015), which is not
619 far from our study site. Gendered differences in roles and tasks might lead to a gendered
620 difference in knowledge of costs and benefits, resulting in differences in the perceptions of
621 and attitudes to langurs.

622

623 CONCLUSION

624 Qinglong village is one of 25 villages where the langurs occur within the reserve
625 (Author, unpubl data). Future studies should cover the other villages and ethnic groups to
626 better understand inter- and intra- village variations in human-langur relationships. This will

627 provide more information to inform reserve-wide conservation management and community
628 development planning.

629 In this study, we highlight the importance of perceived costs and benefits in
630 determining local attitudes toward langurs in Qinglong village of MNNR. We found that
631 respondents with favorable attitudes associated the langurs mainly with tangible benefits and
632 intangible benefits while those with negative attitudes associated the langurs with tangible
633 costs. The respondents' cost and benefit perceptions at the household level were different
634 from those at the community level but both are strongly related to local attitudes. These
635 results indicated that local people's attitudes toward this species are constructed through a
636 multifaceted set of interactions. This suggests that a sole focus on costs or benefits and at
637 only one scale (i.e., household vs. community) may obscure critical information leading to
638 an understanding of people's attitudes toward primates.

639 Crop feeding, house damage, and langur-related tourism are major factors
640 influencing local attitudes toward langurs. It is important for conservation management
641 officials to address these important trade-offs (i.e., property losses and langur-related
642 tourism) and improve policies related to them to maximize the benefits to local communities
643 while mitigating the costs of the langur to local livelihoods. Scientifically-informed tourism
644 guidelines based on langur conservation must be outlined prior to industry development. The
645 land use for infrastructure constructions within the nature reserve should also be strictly
646 evaluated. The positive emotional connection and a local cultural context such as "good to
647 play with langurs" in this study might have a negative outcome for langur conservation if
648 managers do not provide proper interaction guidelines for local people and tourists.

649 Biocultural conservation and education programs (for instance, storytelling) that embed a
650 positive conservation message may be useful to change people’s traditional cultural values
651 of “playing with monkey” (Fernández-Llamazares and Cabeza 2017; Gavin *et al.* 2015; Niu
652 *et al.* 2015). Meanwhile, guides and narrators for tourists should be trained for a more
653 effective langur watching program. These programs should also involve local women and
654 older adults since they more likely have negative attitudes to langurs.

655 This study is a snapshot of the human-langur relationship in MNRR. We identify
656 proximate factors influencing local attitudes that are useful for conservation management.
657 More in-depth investigation on how human and langurs interact across space and time, using
658 an ethnoprimate approach (Dore *et al.* 2018a, b; Fuentes and Hockings 2010), is
659 needed to understand the root causes of the interconnections. Future research on langur
660 foraging behavior, such as the prevalence of crop feeding, and ethnographic data on
661 human-langur ecological overlap and cultural interconnections is urgently needed to protect
662 the population of François' langurs. We suggest that research on socioeconomic patterns and
663 people’s attitudes towards primates should be conducted in protected areas like MNRR to
664 understand the factors that shape human-primate interactions, as well as their changes,
665 especially in the context of rapid economic and infrastructure development.

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