

The Lisu people's traditional natural philosophy and its potential impact on conservation planning in the Laojun Mountain region, Yunnan Province, China

Jie Liu¹ · Dejing Li² · Tetsuro Matsuzawa³ · Satoshi Hirata¹

¹ Wildlife Research Center, Kyoto University, Kyoto, Japan

² Lijiang Dongba Culture Research Institute, Lijiang, Yunnan, China

³ Kyoto University Institute for Advanced Study, Kyoto, Japan

Abstract

In this study, we explored a conservation process from an ethnoprimate perspective for the management of national parks and nature reserves. We accumulated attitude and knowledge data on the traditional culture, religion, and current attitudes to conservation of rural and urban groups of ethnic Lisu people, who live in the village of Liju or have migrated to urban areas, respectively. The data clearly indicated that most of the interviewees had similar feelings and attitudes toward the conservation of Yunnan snub-nosed monkeys (*Rhinopithecus bieti*) and Laojun Mountain National Park (LMNP), irrespective of whether they live in or have moved away from their home village, or if their educational background differs. Both the rural (96.6%) and urban (100%) interviewees expressed their deep affection for Yunnan snub-nosed monkeys and supported (90.3% and 89.0%, respectively) the seasonal closure of mountainous areas for conservation purposes. The Lisu peoples culture, history, and traditions were evaluated with regards to the developing trend for environmentalism, and their advanced attitudes toward environmental protection and resource utilization exceeded our expectations. The results of this study show huge potential for the optimal mitigation of human–animal conflict in the context of conservation planning not only for LMNP but also for other national parks and nature reserves.

Keywords Ethnoprimate · Lisu people · Yunnan snub-nosed monkeys · Conservation

Introduction

Nonhuman primates, our closest biological relatives, coexist with us ecologically, e.g., in terms of our similar diets, and symbolically due to their importance in many cultural mythologies (Fuentes 2006b, 2012). Ethnoprimate is a transdisciplinary field bridging primatology and anthropology (Sponsel 1997; Urbani and Cormier 2015) that explores the complex interactions between humans and other primates and serves to broaden our perspective of nature conservation (Distefano 2005; Nyanganji et al. 2011; Wolfe and Fuentes 2007). Interactions between humans and other primates can be beneficial, harmful, or even both. For instance, in Entebbe, Uganda, vervet monkeys are treated as pests and killed by local farmers because of their crop-raiding behavior (Saj et al. 2001). In the Cape Peninsula, South Africa, massive investment was made through a variety of conservation projects to mitigate conflict caused by the spatial overlap between chacma baboon populations and local residents, although the human–baboon conflict levels remained high (Hoffman and O'Riain 2012). In Balinese culture, macaques are allowed to reside in temples and other religious sites, but human attitudes to them and the impact of land use on them affect both the local ecology and economy (Fuentes 2010). Conservation of endangered species not only involves the development of effective management plans to mitigate reductions in species populations but must also consider the human–wildlife interface (Distefano 2005; Fuentes 2006b, 2012; Knight 2013; Lee and Priston 2005). As nonhuman primate habitats continue to become fragmented and even lost entirely because of human pressure, the need for a discipline that considers human attitudes, perceptions, and behavior regards all aspects of primate survival is imperative (Fuentes 2006b; Fuentes and Hockings 2010; Waters et al. 2018). In other words, an ethnoprimate approach may be important when attempting to create a balance between beneficial and harmful human activities in nonhuman primate habitats.

China is a vast country with abundant resources and a unique geographical location in that it spans the cold temperate, temperate, warm temperate, subtropical, and tropical zones. With ca. 33,000 vascular plant species (30,000 angiosperm, 250 gymnosperm, and 2600 pteridophyte species) (Harkness 1998; Richardson 1990), the vegetation of China contributes to

abundant niches for its primate biodiversity. Twenty-five nonhuman primate species representing one suborder (Prosimii), two subfamilies [Colobinae, Cercopitheciinae (e.g., gibbons)] and eight genera (*Nycticebus*, *Macaca*, *Rhinopithecus*, *Trachypithecus*, *Hylobates*, *Semnopithecus*, *Nomascus*, and *Pygathrix*) have been recorded in China (Cyranoski 2016; Groves 2001).

There are great differences between the 55 ethnic minority groups of China in terms of their culture, economy and attitudes to the natural environment (Jiao 2014; Liu et al. 2010). Although ethnoprimate studies in China are still at an embryonic stage, it is estimated that nonhuman primate distributions in the country could decline by an additional 51–87% in the next 80 years based on a spatial conflict model estimations (Li et al. 2018).

Yunnan Province is not only one of the highest biodiversity hot spots in China, but is also a region of great ethnic diversity (Fan et al. 2017; Jiao 2014; Li et al. 2018; Liao 2008; Matsuzawa 2017). The overwhelming majority of nonhuman primate species in China are found in the south, especially in Yunnan Province, which has 13 species (Li and Lin 1983; Li et al. 2018). In addition, 26 ethnic groups live in Yunnan Province (Doorne et al. 2003; Zhou 2000). There is a long history of coexistence between primate species and local ethnic minority communities in China, e.g., between Yunnan snub-nosed monkeys and the Lisu people in Laojun Mountain National Park (LMNP). Interactions between endemic primate species and local communities in many other areas of China have similar characteristics to those in LMNP, e.g., between Yunnan snub-nosed monkeys and the Tibetan people in the Baima Snow Mountain area, Yunnan Province; Asian elephants (*Elephas maximus*) and the Dai people in Xishuangbanna, Yunnan Province; and François' langur (*Trachypithecus francoisi*) and the Tujia people in Mayanghe National Nature Reserve, Guizhou Province (Long and Kirkpatrick 1994; Hu 2007; Li et al. 2009; Liedigk et al. 2012; Liu et al. 2020)].

Natural philosophy of the Lisu people

The Lisu people are a very ancient ethnic group that formed a relatively independent clan society around the eighth century AD (Meng and Lv 2004), when hunting and plant collecting were the only methods used to obtain food (Compilation group of “Brief history of Lisu” 1983; Si 1999). The Lisu people gradually developed environmental awareness through their interaction with nature over time, and finally changed their attitude to nature from that of conquest to reconciliation (Ai 1999; Compilation group of “Brief history of Lisu” 1983). The Lisu people regarded food as a gift from nature and simultaneously feared the disasters and death brought about by nature. Due to their awe of nature, they began to worship it, and believed that members of the clan could be transformed into animals or plants (Compilation group of “Brief history of Lisu” 1983; You 1994). The Lisu people's natural philosophy formed as a result of their harmonious coexistence with nature (Compilation group of “Brief history of Lisu” 1983; Si 1999; Yang and He 2011), and was deeply embedded in their daily lives for thousands of years (Ai 1999; Nie 2012; Yang and He 2011). As a result of this, the Lisu people had beneficial traditions of forest resource management, utilization of wildlife resources, and sustainable land use, which were passed down from generation to generation until they were improved upon and summarized in a natural calendar (Compilation group of “Brief history of Lisu” 1983; Si 1999). Even after use of this natural calendar diminished, the perceptions and concepts on which it was based were still preserved and inherited culturally (e.g., orally). The Lisu people strongly adhered to their traditional cultural heritage.

Natural calendar of the Lisu people

The Lisu people long used a natural calendar (Ai 1999; Compilation group of “Brief history of Lisu” 1983; Si 1999) to organize their daily lives because of the unpredictable nature of hunting and agricultural production in the area in which they lived. All precautions and restrictions noted in the calendar were stringently adhered to. For instance, apart from the hunting month (December), the Lisu occasionally went hunting during the months of harvest (September and October), winemaking (November), new year celebrations (January), and house building (February). However, hunting was strictly forbidden during the months of flowering (March), birdsong (April), and slash and burn (May). The Gregorian calendar gradually replaced the natural calendar after the founding of the People's Republic of China.

Totemism of the Lisu people

Totem worship is based on nature worship (Peterson 1972; Schwartz 1995). Every ethnic group in China has its own religious beliefs, which are mostly manifested as nature worship. A totem is usually an emblematic object of a clan or a nation,

which they regard with superstitious respect (Frazer 1887; Schwartz 1995). However, the totemism of the Lisu people is to some extent exceptional in that they believe that they are derived from animals and plants (Compilation group of “Brief history of Lisu” 1983; Nie 2012; Yang and He 2011). Each totem is related to the survival and well-being of all its followers, and the Lisu people strongly believe that there is an intimate and special relationship between the followers of a particular totem (Frazer 1887; Nie, 2012; Peterson 1972; Yang and He 2011). Moreover, instead of worshipping a material totem, the Lisu people take as their totem the animal or plant given by their sur- name, which is passed from father to son. The Lisu people have more than 20 surnames, such as tiger, bee, bear, fish, and monkey (Yang and He 2011).

Yunnan snub-nosed monkeys and the Lisu people

Yunnan snub-nosed monkeys are distributed in northwestern Yunnan Province and southeastern Tibet (26°14′–29°20′N, 98°37′–99°41′E). Endemic to the People’s Republic of China, Yunnan snub-nosed monkeys are unquestionably one of the most endangered Old World primates (Liedigk et al. 2012; Long and Kirkpatrick 1994) (Fig. 1). This monkey’s habitat is confined to areas dominated by temperate alpine forests at 3000–4000 m above sea level (Long et al. 1995; Xiang et al. 2010; Wu 1993). Yunnan snub-nosed monkeys are confined to a narrow habitat in the Yunling Mountains between the Yangtze River to the east and the Mekong River to the west, and their population numbers approximately 2000 individuals (Liedigk et al. 2012; Ren 2009). Many ethnic groups lived in harmony with Yunnan snub-nosed monkeys along these two rivers for thousands of years. For example, the Lisu people migrated to northwestern Yun- nan Province, which was inhabited by Yunnan snub-nosed monkeys at the time, during the reign of Emperor Zhenyuan in the Tang Dynasty (around AD 788) (Compilation group of “Brief history of Lisu”, 1983; Gao 2004; Li, 2007; Luo 1993; You 1994). Different ethnic groups give the Yunnan snub-nosed monkey different names: the Lisu people call it *zha mi pu zha* (Harding and Han 2018) or *zha miu wa*, *zha mi*, or *zha miu*, which means “monkey” in the Lisu language. The arrival of Christianity in Yunnan Province can be traced back to 1876–1879 (Compilation group of “Brief history of Lisu” 1983; Shen 2006; Qian 2000). Christianity has had a great influence on the social life of southwestern Chinese ethnic groups, especially the Lisu people (Shen 2006). The history of the discovery of the Yunnan snub-nosed monkey is directly related to Christian missions. For example, Mon- signor Biet, the apostolic bishop of Tibet, arranged for the first collection of seven Yunnan snub-nosed monkey specimens in 1890 in Deqin County (Harding and Han 2018; Milne-Edwards 1870). Yunnan snub-nosed monkeys were first described by Milne-Edwards in 1897, who called them the “monkey of snows” and gave them their specific epithet after Monsignor Biet (Allen 1938; Harding and Han 2018; Milne-Edwards 1870). Thereafter, the further discovery of Yunnan snub-nosed monkeys stagnated for over half a century until 1960 when eight skins were found in Deqin County (Peng et al. 1962). This confirmation of the species’ existence returned the Yunnan snub-nosed monkeys to the public view, and the first generation of primatologists to conduct research on this species began their work on them in the 1990s. At this time, the Lisu people continued to make a living as experienced hunters in the primeval forest of the Yunling Mountains, which made them one of the best candidates as guides when searching for traces of the Yunnan snub-nosed monkey. For example, seven of the nine members of the LMNP ranger team are Lisu. Moreover, the Yunnan snub-nosed monkey is considered an umbrella species that requires a large area for its habitat, thus, protection of this species offers protection to other species that share its habitat in the LMNP (Caro 2003; Long and Kirkpatrick 1994; Roberge and Angelstam 2004).

The barriers of language, culture, and ethnicity are additional challenges for the management of natural reserves (Howard et al. 1991; WallisDeVries et al. 1998). Law enforcement officers frequently encounter cultural and traditional gaps in knowledge that not only affect the efficacy of nature education, but also hinder conservation projects (Groom et al. 2006; Shusta et al. 1995). Cultural tolerance alone protects primates in India and Sulawesi (Lee and Pris- ton 2005), but these species have attracted little scientific attention. Previous studies on human–nonhuman primate conflicts have shown that local communities’ negative attitudes have had a heavy conservation cost, which forced conservation management departments to find less costly and controversial direct wildlife management techniques (Hoff- man and O’Riain 2012; Siex and Struhsaker 1999). As a human–nonhuman primate interface, ethnoprimateology liter- ally and figuratively bridges the gap between respect for and preservation of local ethnic traditions and culture, as well as taking into consideration local ecological knowledge and attitudes as fully as possible (Fuentes and Hockings 2010; Hockings and Sousa 2013; Ohashi 2015). Thus, ethnoprimateology provides data for the improvement of conservation projects and national park management (Braga and Schiavetti 2013; Fuentes 2012). People’s attitudes represent their favorable or unfavorable feelings toward an objective thing or concept (Fishbein et al. 1980; Zelezny 1999). Understanding the factors that shape attitudes, including those of ethnic peoples, towards human–wildlife conflicts are important in predicting human behavior and mitigating these conflicts (Fuentes 2006b, 2006c; Manfredo and Bright 2008; Urbani and Cormier 2015). Previous research on knowledge and attitudes has found strong positive correlations between knowledge and behavior (Costa et al. 2013; White 1993;

Zelezny 1999). Reconciling local ethnic cultural practices with educational intervention could be an effective means of improving conservation measures (Fuentes 2006a, 2012; Urbani and Cormier 2015).

Ethnoprimate studies in China are still at an embryonic stage. This report describes an ethnoprimate study of the Lisu people and Yunnan snub-nosed monkeys, which takes a first look at the vast potential for ethnoprimate in China, especially in Yunnan Province. The aim of our study is to definitively demonstrate the value of ethnoprimate in the conservation of primates and provide new perspectives for conservation planning in this context.

Materials and methods

Study site

LMNP (26°38'N, 99°70'E) is located 80 km northwest of the city of Lijiang, China. The park comprises an upland karst formation spanning 1085 km², which is part of the Three Parallel Rivers World Heritage Site (Policy Research Office of the People's Government of Yunnan Province 2006). In January 2009, the mountainous Laojun region was decreed a Chinese national park for the development of eco-tourism based on the Danxia landform and to promote the conservation of rare species (Research Office of the People's Government of Yunnan Province 2010). This biodiversity hotspot includes more than 1800 widely distributed species, including 51 nationally rare and endangered species. The park also includes a significant portion of the Yunnan snub-nosed monkey's home range, which covers approximately 320 km² of rich natural resources and primeval forest (Fang et al. 2004; Long and Kirkpatrick 1994; Liu et al. 2009; Ren et al. 2009; Wu 2006).

The village of Liju is located adjacent to the LMNP, and has a population of 1360 in 346 households. The population of Liju includes Lisu, Pumi, Yi, and Han ethnic groups; the Lisu comprise the biggest ethnicity (more than 60% of the total population; Fig. 2). The village is divided into 13 sub-settlements distributed across the mountain, some of which are located in remote areas that may take 2 h by motorbike or half a day's walk to access.

Detailed questions regarding perception and attitude were designed for the rural group, which were related to their daily life; data from the urban group were used as the reference standard.

Data collection

In 2017, we conducted pilot interviews with the local Lisu communities during breaks in observing Yunnan snub-nosed monkeys (J. Liu, unpublished data). We designed the interviews and questionnaire based on the results of a pilot study to reflect local knowledge and attitudes. Questions on knowledge included those on demographic, household, and property information, the Lisu people's knowledge of their culture, traditions, and the Yunnan snub-nosed monkey, and LMNP, while questions on perceptions and attitudes included those on Lisu ethnic culture and traditions and towards Yunnan snub-nosed monkeys.

We used semistructured and open-ended interviews together with the questionnaire to elicit information from urban and rural Lisu people, i.e., those living in and outside Liju, in March, September, and December 2018. We used telephone interviews because of time limitations to interview urban clan members living outside Liju, for example, in the cities of Chengdu, Baoshan, Lijiang, and Kunming.

Considering the obstacles of language and the departure of villagers to big cities to work as migrant labor, we tried our best to conduct semistructured interviews with as many residents of the 13 sub-settlements of Liju as possible. These interviewees were classified as the rural group. We systematically interviewed at least two individuals in each household: for example, the household head (who was a married man in most situations), his spouse, parents, children, or siblings.

Semistructured interviews were simultaneously carried out with the group that lived outside the village, i.e., in urban settlements, whom we contacted using introductions of friends and referrals. These interviewees were classified as the urban group. We ensured consistency between the rural and urban interviews by interviewing at least two individuals from each household, i.e., a married man or woman, his/her spouse, parents, children, or siblings.

In the rural group, we conducted semistructured interviews with 175 interviewees from 40 households within the 13 sub-settlements of Liju. In the urban group, we obtained data through interviews with another 109 interviewees from 40 households living outside Liju, such as in Lijiang, Kunming, and Chengdu. The semistructured interviews, questionnaire surveys, and Likert scale statements (Joshi et al. 2015; Malhotra 2006) were used to evaluate interviewees' attitudes

towards and perceptions of Yunnan snub-nosed monkeys and LMNP. The Likert scale is extensively used in conservation research to measure multiple dimensions of attitude of interviewees (Alexander 2000; Bernard 1995; Ellwanger et al. 2015). We recorded all feedback from the interviewees in addition to any comments and extra information they volunteered during the interviews.

Data analysis

All interview data were analyzed using R (version 3.5.3) and Excel (Microsoft, Redmond, WA) software. Descriptive statistics were used to provide demographic information. The knowledge and attitudes data from interviews were assessed using a Likert scale (Tables 1, 2). We converted answers to scores: positive attitudes = 1, moderate attitudes = 0.5, negative attitudes = 0; we did not score responses of “Don’t know” (Braga and Schiavetti 2013; Ellwanger et al. 2015). The final scores were divided into three categories: negative (0–0.33), moderate (0.34–0.66), and positive (0.67–1). To visualize the pattern of questionnaire responses from urban and rural inhabitants, we used Hayashi’s quantification method type III, which can deal with categorical and qualitative data (Hayashi 1972). Rural and urban people’s responses to a total of 20 questionnaires were used as the variables in our analyses. The aim of this analysis was to visualize the differences in questionnaire responses between the rural and urban inhabitants.

Results

Demographic information

The demographic information of the interviewees is shown in Tables 3 and 4. Family composition, education level, and income level all differed between the Lisu people living in and outside Liju. The mean household size of rural Lisu was 4.4 people (range 1–6), while that of urban Lisu was 2.7 (range 2–3). Most rural Liju had an education level lower than middle school, while all urban Liju had at least high school education. The average annual income for the rural and urban groups in 2018 ranged from 4000 to 35,000 RMB (approximately 569.54 to 4983.48 USD).

Knowledge and attitudes

The frequencies of responses to the Likert scale statements were summarized for the rural and urban groups (Tables 1, 2). The results of Hayashi’s quantification method type III analysis illustrate the differential response patterns between the rural and urban groups’ answers to the 20 questions of the questionnaires (Fig. 3).

Natural calendar

Both rural and urban groups had completely abandoned use of the natural calendar (Table 5). However, the perception of sustainable environmental protection, which was derived from the natural calendar, was still rooted in the Lisu people’s consciousness.

Of the 175 rural Lisu, 158 (90.3%) said they supported the seasonal closure of mountainous areas, while only one (0.6%) responded negatively, nine (5.1%) said “Don’t know,” and seven (4.0%) had a neutral opinion. Of the urban interviewees, 97 (89.0%) supported the seasonal closure of mountainous areas, while one (0.9%) responded negatively, one (0.9%) said “Don’t know,” and ten (9.2%) expressed a neutral opinion (Tables 1, 2). Attitudes did not significantly differ between the rural and urban groups ($\chi^2 = 6.5366$, $p > 0.05$). However, 138 interviewees (68/175 from the rural group, 70/109 from the urban group) told us they would like to follow the traditional way of managing the LMNP, like their ancestors did by following the natural calendar. Of those who supported the seasonal closure of mountainous areas, some thought that “it was right and natural to give the mountain a break.” Some interviewees indicated that they had heard stories about their grandparents’ daily lives from their parents or older siblings. Some had asked their parents questions about extending the hunting period (e.g., a man in his forties asked his mother “why did they not hunt all year round so

they may have more food to eat?” and “why did they not hunt more frequently so that they would not go hungry”), and their parents often answered these questions using natural common sense or an anthropomorphic expression (e.g., a man in his forties recalled his parents answering that “it is just like we pick fruit only after it matures, not before” and “we need rest and so does the mountain”).

Totemism

The knowledge that regional surnames were related to totems did not significantly differ between the rural and urban groups ($\chi^2 = 0.2139, p > 0.05$). Most of the interviewees could clearly articulate the connection between their surname and totem. A comparison between the rural and urban groups showed that perception of and attitude towards religious household totems differed significantly ($\chi^2 = 23.0664, p < 0.05$).

The urban group (77.1%) had stronger totemic beliefs than the rural group (49.7%) (Tables 1, 2). Also, significantly more of the urban group (61.5%) owned a traditional costume than the rural group (22.9%) (Tables 1, 2). When we asked the interviewees “Does traditional costume have some special meaning for you?” and “How often do you wear the traditional costume?”, some from the urban group explained that they consider their traditional costume part of themselves and proudly wear it to show their ethnic identity (e.g., a woman in her twenties said that she “wore the traditional costume at the opening ceremony of the university,” while a boy in his twenties said that he “wore the traditional costume many times during team building parties and year-end meetings”). Some interviewees from the rural group considered the traditional costume to be the same as every-day clothing (a woman in her thirties said: “the color of the traditional costume is dark and not fashionable”).

Yunnan snub-nosed monkeys

Rural (96.6%) and urban (100%) interviewees expressed their deep affection for Yunnan snub-nosed monkeys. Rural people were aware that the Yunnan snub-nosed monkey is a protected species; however, only 32.6% could describe its protection level, whereas 94.5% of the urban interviewees clearly knew this.

One of the questions tested the perception and attitudes of the interviewees regards their own clan totem versus Yunnan snub-nosed monkeys. Of the 175 rural Lisu, 50 (28.6%) preferred their own totem to Yunnan snub-nosed monkeys, while 55 (31.4%) gave the opposite response, 18 (10.3%) responded “Don’t know,” and 52 (29.7%) were neutral. Of the urban interviewees, 75 (68.8%) preferred their own clan totem to Yunnan snub-nosed monkeys, while five (4.6%) gave the opposite response, none (0%) said “Don’t know,” and 29 (26.6%) were neutral (Tables 1, 2). The comparison of the rural and urban groups’ preference for their own household totem or Yunnan snub-nosed monkeys showed a significant difference ($\chi^2 = 56.5236, p < 0.05$). The rural interviewees often hesitated and struggled to make a choice between the two (e.g., a man in his forties from the bee clan said: “monkey, wait ... wait, and bee, can I choose both?” and immediately before the interviewer left his house asked if he could change his choice back to bee). The urban interviewees were often excitable and proud when giving their answer (e.g., a man in his thirties who was a member of the bear clan said, “Absolutely bear, I am my clan totem”). Attitudes were not significantly different between the rural and urban groups when asked “Do you prefer to live in LMNP without Yunnan snub-nosed monkeys” ($\chi^2 = 1.5827, p > 0.05$; Tables 1, 2). Regardless of whether interviewees had experienced living with Yunnan snub-nosed monkeys or not, their attitude appeared to agree with that considered their ancestors’ (e.g., a man in his eighties said: “monkeys are spiritual, the mountains will lose its spirituality without the golden monkeys”).

Laojun Mountain National Park

Rural and urban groups had significantly different perceptions about the importance of LMNP to the conservation of Yunnan snub-nosed monkeys ($\chi^2 = 25.0213, p < 0.05$). Of the 175 rural Lisu, 46 (26.3%) said that LMNP was crucial for the conservation of the monkeys, 57 (32.6%) responded negatively, while 32 (18.3%) responded “Don’t know,” and 40 (22.9%) were neutral. Of the 109 urban Lisu, 49 (45.0%) considered that the LMNP is crucial for the conservation of Yunnan snub-nosed monkeys, while 19 (17.4%) responded negatively, five (4.6%) responded “Don’t know,” and 36 (33.0%) were neutral (Tables 1, 2). The rural group considered that Yunnan snub-nosed monkeys would always coexist with local communities whether there was the LMNP or not. Only 19 (10.9%) of the rural Lisu felt that the LMNP had some negative effects on their livelihoods. Probably owing to local long-term conservation and legally enforced educational

propaganda, 98.3% of the rural interviewees clearly understood the relevant prohibitions (e.g., no logging or hunting in the LMNP). The majority of the Lisu people interviewed (69.1%) supported the banning of hunting in the LMNP. A few interviewees (14.3%) said they supported hunting, while the remainder (5.1%) responded neutrally. We deliberately divided firewood collection into two categories: wood collected without lumbering, and wood collected with logging. The majority of rural Lisu (68.0%) considered that collecting firewood without lumbering should be allowed. However, 59.4% of these interviewees supported the collection of firewood by logging (e.g., a man in his fifties said: “logging should be allowed, I will not cut all the trees down. I will hand down the forest to my son in the same way that I took it over from my father”).

During the interviews focusing on Lisu people’s attitude towards LMNP, we recorded seven cases of black bears (*Ursus thibetanus*) that had attacked and killed domestic cattle. None of the interviewees blamed the bears for this (e.g., a man in his sixties said, “it’s normal, the bear has the ability to eat cattle. I had a shotgun when I was young and I also hunted bear to eat”). However, all of the interviewees were very dissatisfied with the government’s compensation policy (e.g., a woman in her forties said that it was “such stingy compensation, and the claim procedure is too cumbersome. I waited for 9 months and spent so much time contacting public officials, but still have not received compensation”).

Discussion

Natural philosophy in regard to conservation

Natural philosophy in regard to conservation can be a double-edged sword. On the one hand, the Lisu people still maintain the natural philosophy of forest resource management, utilization of wildlife resources, and sustainable land use, which has been handed down to them. This natural philosophy makes it easier to effectively achieve conservation goals. Although family composition, income level, and importantly, education level, differed between the rural and urban groups, they both supported the conservation project even without understanding the importance of national parks and nature reserves (e.g., only 26.3% of the rural group interviewees and 45.0% of the urban group interviewees recognized the value of national park for the conservation of Yunnan snub-nosed monkeys). Their attitude scores regards “I support seasonal closure of mountainous areas” were all positive (rural group, 0.92; urban group, 0.94). The Lisu people do not believe in human supremacy. Although they had poor knowledge of Yunnan snub-nosed monkeys (e.g., only 32.6% of the interviewees in the rural group knew the protection level of the monkeys, while 94.5% of the urban group interviewees could answer this question clearly), their response scores for the statement “I prefer to live here without Yunnan snub-nosed monkeys” were consistently negative (rural group, 0.01; urban group, 0.00).

The Lisu people’s natural philosophy ensured that conservation goals could be achieved easily in the LMNP; however, their education level determined their assessment of the appropriateness of the conservation measures. Therefore, there is still a need for better monitoring of the implementation of conservation goals. *Kao shan chi shan, kao shui chi shui* (i.e., living from what the mountain and water can provide) is an old Chinese proverb that describes folk customs in regards to nature resource utilization. Most local communities use this proverb as a guideline, and even sometimes as a legal basis for their use of resources. This proverb is indicative of the Lisu people’s attitude to firewood collection. The rural group’s attitude scores for “people should be allowed to collect firewood in LMNP (no lumbering)” and “people should be allowed to log for firewood in LMNP (lumbering)” were all positive (0.76 and 0.69, respectively). Meanwhile, the attitude scores of urban people regards firewood collection were moderate (0.62) and negative (0.04). There is an essential difference between lumbering for firewood and acquiring firewood by collecting (no logging), and the results indicate that guidance, through appropriate nature education and legal advocacy, is still necessary for the gathering of wood for fuel.

Ethnoprimateology in conservation

Ethnoprimateology is an important factor in the balance between beneficial and harmful human–nonhuman primate interactions that influences conservation activities. Nature protection laws are currently focused on protected species, and mostly ignore local communities’ immediate interests (e.g., the case of the black bear in the LMNP). Based on the traditional perceptions of the Lisu people, natural disasters or animal attacks are not major concerns, thus, they can accept the prohibitions imposed in the LMNP. Both rural (0.98) and urban (0.82) groups showed positive attitude scores for “I know about prohibited items in the LMNP.” They also showed consistently negative attitude scores for “There were negative effects on my livelihood after Laojun Mountain became a national park” (rural group, 0.27; urban group, 0.24).

However, the Lisu people were not satisfied with the government's compensation policy. Therefore, law enforcement officers frequently encounter cultural and traditional gaps in understanding that not only affect the efficacy of nature education, but also block conservation projects (Groom et al. 2006; Shusta et al. 1995). Owing to the nature-friendly attitudes and perceptions of the Lisu people, the core of this contradiction appears not to be a human-non-human primate or human-nature issue but a management one. During the interviews, we rarely received any negative feedback about Yunnan snub-nosed monkeys or other animals. Meanwhile, we heard many complaints about the management of the LMNP. For instance, the attitude scores of rural (0.77) and urban (0.84) groups on "People should be allowed to use resources in the LMNP" were positive. Taking into account the above, we consider that management rules based on ethnoprimateology can be used for the more effective implementation of conservation principles in this area.

Previous research has indicated that barriers of language, culture, and ethnicity can be challenging in the context of nature conservation (Howard et al. 1991; Wallis De Vries et al. 1998). However, turning these barriers into bridges can be an important driver for conservation projects. The key means for this is the improvement of human-nonhuman primate interactions, as these can be beneficial or harmful depending on people's attitudes, which are rooted in their different cultures and histories. Ethnoprimateology is an important factor in the balance between beneficial and harmful activities, as confirmed by the current study. Although many of the Lisu people interviewed live far from their home town, or have different educational backgrounds, they expressed similar sentiments and attitudes toward Yunnan snub-nosed monkeys and the LMNP. For example, both rural (96.6%) and urban (100%) groups said they liked Yunnan snub-nosed monkeys, and the attitude scores of rural (0.01) and urban (0.00) groups for "I prefer to live here without Yunnan snub-nosed monkeys" were consistently negative. The interviewees were not extremists in terms of nature protection, but neither did they support the destructive utilization of natural resources. Most of the interviewees' attitudes and perceptions matched those promoted by environmentally friendly and sustainable development measures; for example, rural (90.3%) and urban (89.0%) interviewees supported the seasonal closure of mountainous areas for the recovery of natural resources. The origins of this environmentalism can be traced back to the increasing levels of atmospheric pollution during the Industrial Revolution (Caradonna 2014; Guha 2014). After looking closely at the Lisu people's history, culture, and traditions, we found that their attitudes toward environmental protection and natural resource utilization are advanced and aligned with current philosophies in terms of environmentalism. Law enforcement and conservation management have thus far built a promising foundation for achieving conservation aims in the LMNP. In addition to these strategies, vigorous support and guidance from scientific research is necessary to deliver a better future for conservation management, and ethnoprimateology can contribute to this. This study illustrates the potential for optimal mitigation of human-animal conflict for better conservation planning not only for the LMNP, but also for other national parks and nature reserves.

Acknowledgements This research was funded by the Japan Society for the Promotion of Science (KAKENHI grant nos. 24000001 and 16H06283, LGP-U04, and Core-to-Core CCSN to T. M.). We gratefully acknowledge the support from Kyoto University and its Wildlife Research Center, the Nature Conservancy and Lijiang Laojun Mountain Biodiversity Conservation Center. We also thank Prof. Li Jiaochang (Yunnan Minzu University) and Mrs. He Wenqin (Lisu Culture Research Association) for their support of our study, Mr. Yutaro Sato and Dr. Niu Kefeng for their help in data collection and analysis, and Ms. Kristin Havercamp (Wildlife Research Center of Kyoto University) and Peter Fogarty (Edanz Group: www.edanzediting.com) for editing a draft of this manuscript.



Fig. 1 Yunnan snub-nosed monkey in Tacheng Prefecture (photo- graph: J. Liu)



Fig. 2 Lisu people in their traditional costume (photograph: Mrs. He Wenqin)

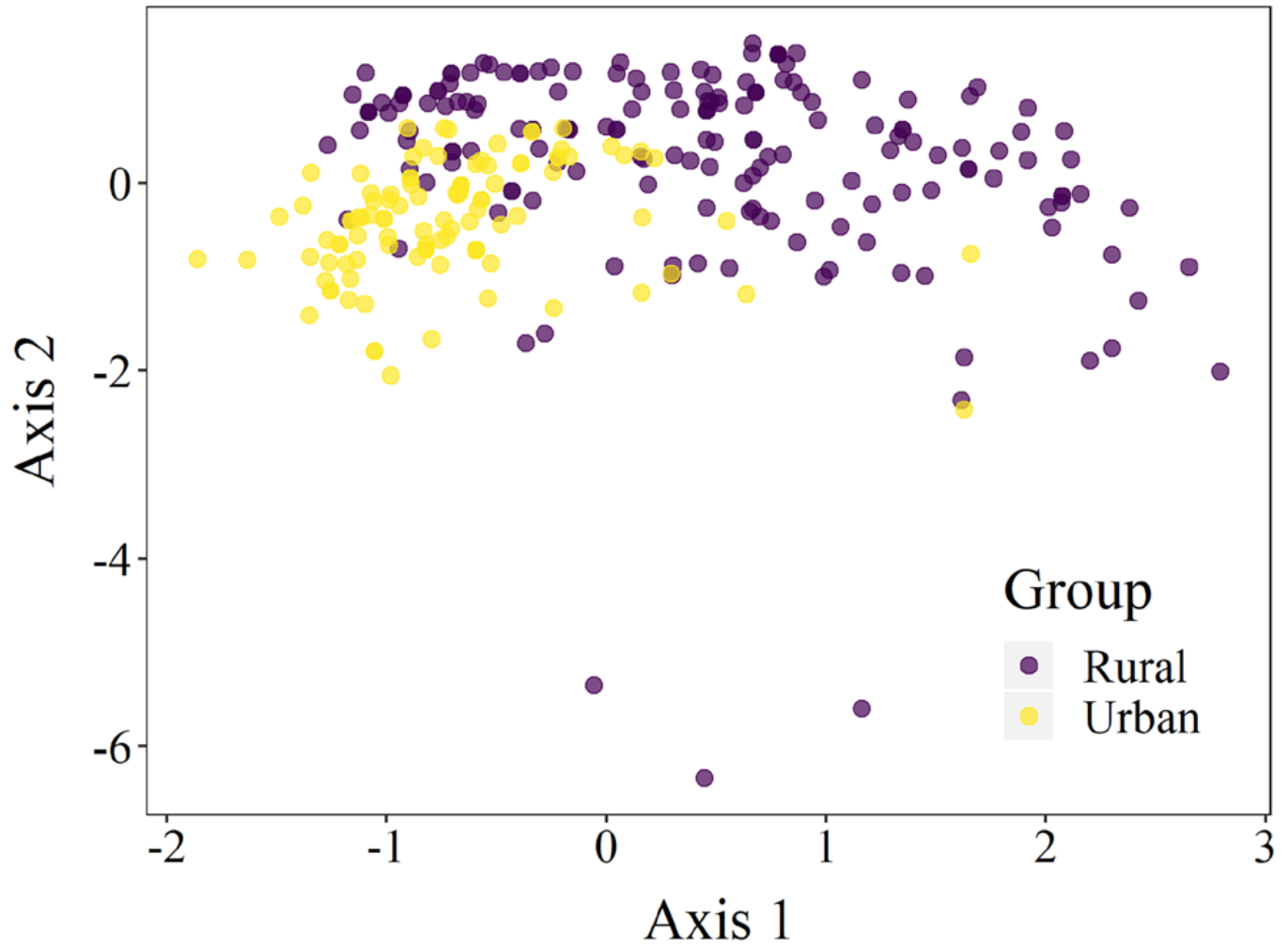


Fig. 3 Hayashi's quantification method type III analysis

Table 1 Rural knowledge and attitudes ($n = 175$)

Statements	Agree	Neutral	Disagree	Don't know	Attitude score ^a
I can speak the Lisu language	100.0	0.0	0.0	0.0	1.00
I have a Lisu traditional costume	22.9	0.0	77.1	0.0	0.23
I know the origin of my surname	68.0	0.0	32.0	0.0	0.68
I am a Christian	11.4	0.0	88.6	0.0	0.11
I am a Buddhist	4.6	0.0	95.4	0.0	0.05
I believe in my clan totem	49.7	24.0	9.7	16.6	0.62
I know about the Lisu natural calendar	38.9	0.0	61.1	0.0	0.39
The Lisu natural calendar is in use in my family	0.0	0.0	100.0	0.0	0.00
I like Yunnan snub-nosed monkeys	96.6	1.7	1.7	0.0	0.97
I know the exact protection level of Yunnan snub-nosed monkeys	32.6	0.0	67.4	0.0	0.33
I prefer my totem to Yunnan snub-nosed monkeys	28.6	29.7	31.4	10.3	0.43
Yunnan snub-nosed monkeys will become extinct without national parks or nature reserves like LMNP	26.3	22.9	32.6	18.3	0.38
I prefer to live here without Yunnan snub-nosed monkeys	0.0	2.9	94.9	2.3	0.01
There were negative effects on my livelihood after Laojun Mountain became a national park	10.9	33.1	51.4	4.6	0.27
I know about prohibited items in the LMNP	98.3	0.0	1.7	0.0	0.98
People should be allowed to use the resources in the LMNP	66.3	20.6	2.3	10.9	0.77
People should be allowed to hunt in the LMNP	14.3	5.1	69.1	11.4	0.17

People should be allowed to collect firewood in LMNP (no lumbering)	68.0	16.6	7.4	8.0	0.76
People should be allowed to log for firewood in LMNP (lumbering)	59.4	19.4	8.0	13.1	0.69
I support seasonal closure of mountainous areas	90.3	4.0	0.6	5.1	0.92

^aExpected attitude scores (%)

Table 2 Urban knowledge and attitudes (*n* = 109)

Statements	Agree	Neutral	Disagree	Don't know	Attitude score ^a
I can speak the Lisu language	100.0	0.0	0.0	0.0	1.00
I have a Lisu traditional costume	61.5	0.0	38.5	0.0	0.61
I know the origin of my surname	70.6	0.0	29.4	0.0	0.71
I am a Christian	31.2	0.0	68.8	0.0	0.31
I am a Buddhist	9.2	0.0	90.8	0.0	0.09
I believe in my clan totem	77.1	12.8	6.4	3.7	0.83
I know about the Lisu natural calendar	64.2	0.0	35.8	0.0	0.64
The Lisu natural calendar is in use in my family	0.0	0.0	100.0	0.0	0.00
I like the Yunnan snub-nosed monkey	100.0	0.0	0.0	0.0	1.00
I know the exact protection level of the Yunnan snub-nosed monkey	94.5	0.0	5.5	0.0	0.94
I prefer my totem to the Yunnan snub-nosed monkey	68.8	26.6	4.6	0.0	0.82
The Yunnan snub-nosed monkey will become extinct without national parks or nature reserves like the LMNP	45.0	33.0	17.4	4.6	0.61
I prefer to live here without the Yunnan snub-nosed monkey	0.0	0.0	100.0	0.0	0.00
There were negative effects on my livelihood after Laojun mountain became a national park	6.4	34.9	38.5	20.2	0.24
I know about prohibited items in the LMNP	68.8	26.6	1.8	2.8	0.82
People should be allowed to use the resources in the LMNP	76.1	15.6	7.3	0.9	0.84
People should be allowed to hunt in the LMNP	3.7	3.7	89.9	2.8	0.06
People should be allowed to collect firewood in LMNP (no lumbering)	42.2	39.4	14.7	3.7	0.62
People should be allowed to log for firewood in LMNP (lumbering)	0.0	7.3	86.2	6.4	0.04
I support seasonal closure of mountainous areas	89.0	9.2	0.9	0.9	0.94

^aExpected attitude scores (%)

Table 3 Rural demographic information (*n* = 175)

Gender	Number of interviewees	Mean age (range)	Education	Occupation
Male	101	42 (19–82)	None	15
			Primary	41
			Middle	36
			High	8
			Undergraduate	1
			Graduate and above	0
Female	74	45 (18–82)	None	35
			Primary	26
			Middle	9
			High	4
			Undergraduate	0
			Graduate and above	0

Table 4 Urban demographic information (*n* = 109)

Gender	Number of interviewees	Mean age (range)	Education	Occupation		
Male	55	33 (16–51)	None	0	Farmer	0
			Primary	0	Laborer	21
			Middle	0	Student	11
			High	31	Business	16
			Undergraduate	23	Teacher	7
			Graduate and above	1	Unemployed	0
Female	54	28 (15–48)	None	0	Farmer	0
			Primary	0	Laborer	14
			Middle	0	Student	17
			High	27	Business	17
			Undergraduate	25	Teacher	6
			Graduate and above	2	Unemployed	0

Table 5 Lisu natural calendar

Lisu natural calendar	English name	Gregorian calendar month
Hua Kai Yue/Tao Hua Yue	Month of flower blossoming	March
Niao Jiao Yue	Month of birdsong	April
Shao Shan Yue	Month of slash and burn	May
Ji Huang Yue	Month of famine	June
Cai Ji Yue	Month of collection	July and August
Shou Huo Yue/Qiu Shou Yue	Month of harvest	September and October
Zhu Jiu Yue	Month of winemaking	November
Shou Lie Yue	Month of hunting	December
Guo Nian Yue	Month of the new year celebration	January
Gai Fang Yue	Month of house building	February

References

- Ai HS (1999) Hunting culture and biodiversity protection of Lisu nation in Gaoligongshan area. *Yunnan Geogr Environ Res* 1:75–80 (**in Chinese with an English abstract**)
- Alexander SE (2000) Resident attitudes towards conservation and black howler monkeys in Belize: the Community Baboon Sanctuary. *Environ Conserv* 27(4):341–350
- Allen GM (1938) The mammals of China and Mongolia [natural history of central Asia (W. Granger)]. *Central Asiat Exped Am Mus Nat Hist* (NY) 11:1–620
- Bernard HR (1995) Research methods in anthropology: qualitative and quantitative approaches. AltaMira, Walnut Creek
- Braga HDO, Schiavetti A (2013) Attitudes and local ecological knowledge of expert fisherman in relation to conservation and bycatch of sea turtles (*Reptilia testudines*), Southern Bahia, Brazil. *J Ethnobiol Ethnomed*. <https://doi.org/10.1186/1746-4269-9-15>
- Caradonna JL (2014) Sustainability: a history. Oxford University Press, New York
- Caro TM (2003) Umbrella species: critique and lessons from East Africa. *Animal Conserv* 6(2):171–181
- Compilation group of “Brief history of Lisu” (1983) Brief history of Lisu. Yunnan Provincial People’s Press, Kunming (**in Chinese**)
- Costa S, Casanova CC, Sousa C, Lee PC (2013) The good, the bad and the ugly: perceptions of wildlife in Tombali (Guinea-Bissau, West Africa). *J Primatol* 2(1)
- Cyranski D (2016) Monkey kingdom: China is positioning itself as a world leader in primate research. *Nature* 532:300–302. <https://doi.org/10.1038/532300a>
- Distefano E (2005) Human-wildlife conflict worldwide: collection of case studies, analysis of management strategies and good practices. Sustainable Agriculture and Rural Development Initiative (SARDI), Food and Agricultural Organization of the United Nations (FAO), Rome. FAO Corporate Document Repository <http://www.fao.org/documents>
- Doorne S, Ateljevic I, Bai Z (2003) Representing identities through tourism: encounters of ethnic minorities in Dali, Yunnan Province, People’s Republic of China. *Int J Tour Res* 5(1):1–11

- Ellwanger AL, Riley EP, Niu K, Tan CL (2015) Local people's knowledge and attitudes matter for the future conservation of the endangered guizhou snub-nosed monkey (*Rhinopithecus brelichi*) in Fanjingshan National Nature Reserve, China. *Int J Primatol* 36(1):33–54
- Fan PF, He K, Chen X, Ortiz A, Zhang B, Zhao C, Groves C (2017) Description of a new species of Hoolock gibbon (Primates: Hylobatidae) based on integrative taxonomy. *Am J Primatol* 79(5):e22631
- Fang J, Shen Z, Tang Z, Wang Z (2004) The protocol for the survey plan for plant species diversity of China's mountains. *Biodivers Sci* 12(1):5–9
- Fishbein M, Jaccard J, Davidson AR, Ajzen I, Loken B (1980) Predicting and understanding family planning behaviors. In: Understanding attitudes and predicting social behavior. Prentice Hall, Upper Saddle River
- Frazer JG (1887) Totemism. A. & C. Black
- Fuentes A (2006a) The humanity of animals and the animality of humans: a view from biological anthropology inspired by J. M. Coetzee's *Elizabeth Costello*. *Am Anthropol* 108(1):124–132
- Fuentes A (2006b) Human culture and monkey behavior: assessing the contexts of potential pathogen transmission between macaques and humans. *Am J Primatol* 68:880–896
- Fuentes A (2006c) Human-nonhuman primate interconnections and their relevance to anthropology. *Ecol Environ Anthropol* 2(2):1–11
- Fuentes A (2010) Naturalcultural encounters in Bali: monkeys, temples, tourists, and ethno-primateology. *Cult Anthropol* 25(4):600–624
- Fuentes A (2012) Ethno-primateology and the anthropology of the human-primate interface. *Annu Rev Anthropol* 41:101–117
- Fuentes A, Hockings KJ (2010) The ethnoprimatological approach in primatology. *Am J Primatol* 72(10):841–847
- Gao ZY (2004) A study on the history of the Lisu and Nu ethnic peoples from the Tang Dynasty to the Ming Dynasty. *Acad Explor* 8:102–106 (in Chinese with an English abstract)
- Groom MJ, Meffe GK, Carroll CR (2006) Principles of conservation biology. Sinauer, Sunderland, MA
- Groves C (2001) Primate taxonomy. Smithsonian Series in Comparative Evolutionary Biology. Smithsonian, Washington, p 1
- Guha R (2014) Environmentalism: a global history. Penguin, London
- Harding LE, Han LX (2018) *Rhinopithecus bieti* (Primates: Cercopithecidae)
- Harkness J (1998) Recent trends in forestry and conservation of biodiversity in China. *China Q* 156:911–934
- Hayashi C (1972) Quantification theory. Japan Newspaper Office of Economy, Tokyo
- Hockings KJ, Sousa C (2013) Human-chimpanzee sympatry and interactions in Cantanhez National Park, Guinea-Bissau: current research and future directions. *Primate Conserv* 26(1):57–66
- Hoffman T, O'Riain M (2012) Monkey management: using spatial ecology to understand the extent and severity of human–baboon conflict in the Cape Peninsula, South Africa. *Ecol Soc* 17(3)
- Howard PC, Butler J, Howard P (1991) Nature conservation in Uganda's tropical forest reserves. IUCN, Gland, Switzerland and Cambridge, UK with the financial support of WWF-International. *Mamm Species* 50(969):148–165
- Hu G (2007) Socioecology and behavioral flexibility of François' langur (*Trachypithecus francoisi*) in Mayanghe Nature Reserve, Southwest China. PhD thesis, the Australian National University
- Jiao KS (2014) Spatial statistical analysis of the distribution and changes of ethnic minority population in China. *J Southwest Univ Natl (Hum Soc Sci Edn)* 278(10):26–32 (in Chinese)
- Joshi A, Kale S, Chandel S, Pal DK (2015) Likert scale: explored and explained. *Br J Appl Sci Technol* 7(4):396
- Knight J (2013) Introduction. In: Knight J (ed) Natural enemies: people-wildlife conflicts in anthropological perspective. Routledge, London, pp 1–35
- Lee PC, Priston NE (2005) Human attitudes to primates: perceptions of pests, conflict and consequences for primate conservation. *Commensalism Conflict: Hum-Primate Interface* 4:1–23
- Li WQ (2007) Distribution of the Lisu during the Tang to the Qing Dynasty. *J Lincang Normal College* 4:16–18 (in Chinese)
- Li ZX, Lin ZY (1983) Classification and distribution of living primates in Yunnan, China. *Zool Res* 4(2):111–120
- Li ZL, Chen MY, Wu ZL, Wang Q, Dong YH (2009) Perception and attitude of rural community to the construction of Asian elephant conservation corridors in Xishuangbanna. *Chin J Appl Ecol* 20(6):1483
- Li B, Li M, Li J, Fan P, Ni Q, Lu J, Zhou X, Long Y, Jiang Z, Zhang P, Huang Z, Huang C, Jiang X, Pan R, Gouveia S, Dobrovolski R, Grueter CC, Oxnard C, Groves C, Estrada A, Garber PA (2018) The primate extinction crisis in China: immediate challenges and a way forward. *Biodivers Conserv* 27(13):3301–3327
- Liao Q (2008) The status and distribution of nonhuman primates in Yunnan. *Sci Technol Inf* 9:226–249
- Liedig R, Yang M, Jablonski NG, Momberg F, Geissmann T, Lwin N, Hla HT, Liu Z, Wong B, Ming L, Yongcheng L (2012) Evolutionary history of the odd-nosed monkeys and the phylogenetic position of the newly described Myanmar snub-nosed monkey *Rhinopithecus strykeri*. *PLOS ONE* 7(5):e37418
- Liu ZJ, Ren BP, Wu RD, Zhao L, Hao YL, Wang BS, Wei FW, Long YC, Li M (2009) The effect of landscape features on population genetic structure in Yunnan snub-nosed monkeys (*Rhinopithecus bieti*) implies an anthropogenic genetic discontinuity. *Mol Ecol* 18(18):3831–3846
- Liu CF, Chong WZ, Liu RQ, Zhang RR (2010) Spatial statistical analysis of the distribution of ethnic population in Yunnan Province. *Stat Inf Forum* 25(11):87–93 (in Chinese with an English abstract)
- Liu J, Fitzgerald M, Liao HH, Luo YM, Jin T, Li XL, Yang XY, Hirata S, Matsuzawa T (2020) Modeling habitat suitability for Yunnan Snub-nosed monkeys in Laojun Mountain National Park. *Primates* 61:277–287
- Long Y, Kirkpatrick CR (1994) Report on the distribution, population, and ecology of the Yunnan snub-nosed monkey (*Rhinopithecus bieti*). *Primates* 35(2):241–250
- Long YC, Zhong T, Xiao L (1995) Conservation strategy for the Yunnan snub-nosed monkey. Primate research and conservation. China Forestry Publishing House, Beijing, pp 157–164
- Luo XY (1993) Yunnan national record in the Yuan Dynasty—"Yunnan chorography". *Ethn Stud* 1:93–101 (in Chinese)
- Malhotra NK (2006) Questionnaire design and scale development, Chap 5. In: The handbook of marketing research: uses, misuses, and future advances. Sage Publications Inc., Newbury Park, pp 176–202
- Manfredo MJ, Bright AD (2008) Attitudes and the study of human dimensions of wildlife. In: Who cares about wildlife? Springer, New York, NY, pp 75–109

- Matsuzawa T (2017) Monkeys and mountains in Yunnan, China. *Primates* 58(3):379
- Meng R, Lv X (2004) Lisu's eco-view and its meaning today. *J Yunnan Normal Univ* 36(3):71–74 (in Chinese)
- Milne-Edwards A (1870) Note sur quelques mammifères du Thibet oriental. *Comp Acad Sci (Paris)* 70:341–342
- Nie LJ (2012) A Study of the relationship between primitive religious belief and surname culture of Lisu—at Jianghua, Yunnan. *J Kunming Univ* 34(2):95–98 **(in Chinese with an English abstract)**
- Nyanganji G, Fowler A, McNamara A, Sommer V (2011) Monkeys and apes as animals and humans: ethno-primateology in Nigeria's Taraba region. In: Sommer V, Ross C (eds) *Primates of Gashaka. Socioecology and conservation in Nigeria's biodiversity hotspot*. Springer, New York, NY, pp 101–134
- Ohashi G (2015) Pestle-pounding and nut-cracking by wild chimpanzees at Kpala, Liberia. *Primates* 56(2):113–117
- Peng HS, Gao YT, Liu CK, Feng ZJ, Chen QX (1962) Report on mammals from south-west Szechwan and northwest Yunnan. *Acta Zool Sin* 14:105–129 **(in Chinese with an English abstract)**
- Peterson N (1972) Totemism yesterday: sentiment and local organisation among the Australian Aborigines. *Man* 7(1):12–32
- Policy Research Office of the People's Government of Yunnan Province (2006) *The three parallel rivers*. Yunnan People's Publishing House, Kunming
- Qian N (2000) The spread and influence of Christianity in Yunnan ethnic society. *World Relig Res* 3:19 **(in Chinese with an English abstract)**
- Ren BP (2009) Influence of day length, ambient temperature, and seasonality on daily travel distance in the Yunnan snub-nosed monkey at Jinsichang, Yunnan, China. *Am J Primatol* 71:233–241
- Ren BP, Li M, Long YC, Wu RD, Wei FW (2009) Home range and seasonality of Yunnan snub-nosed monkeys. *Integr Zool* 4(2):162–171
- Richardson SD (1990) *Forests and forestry in China: changing patterns of resource development*. Island Press, Washington, DC
- Roberge JM, Angelstam PER (2004) Usefulness of the umbrella species concept as a conservation tool. *Conserv Biol* 18(1):76–85
- Research Office of the Peoples Government of Yunnan Province (2010) *Yunnan National Park Management Office, and the Nature Conservancy, China Office. Resource book of Yunnan National Park policy and research*. People's Government of Yunnan, Kunming
- Saj TL, Sicotte P, Paterson JD (2001) The conflict between vervet monkeys and farmers at the forest edge in Entebbe, Uganda. *Afr J Ecol* 39(2):195–199
- Schwartz T (1995) Cultural totemism: ethnic identity, primitive and modern. In: Romanucci-Ross L, De Vos G (eds) *Ethnic identity: creation, conflict, and accommodation*, pp 48–72
- Shen J (2006) Christianity and the Nujiang society. *Hist Teach Issues* 1:17–18 **(in Chinese with an English abstract)**
- Shusta RM, Levine DR, Harris PR, Wong HZ (1995) *Multicultural law enforcement*. Prentice Hall, Englewood Cliffs, NJ
- Si LY (1999) *The Lisu culture*. Yunnan Nationalities Press, Kunming **(in Chinese)**
- Siex KS, Struhsaker TT (1999) Colobus monkeys and coconuts: a study of perceived human–wildlife conflicts. *J Appl Ecol* 36(6):1009–1020
- Sponsel LE (1997) The human niche in Amazonia: explorations in ethno-primateology. In: Kinzey WG (ed) *New world primates: ecology, evolution, behavior*. Aldine De Gruyter, New York, pp 43–165
- Urbani B, Cormier LA (2015) The ethnoprimatology of the howler monkeys (*Alouatta* spp.): from past to present. In: Kowalewski M, Garber P, Cortés-Ortiz L, Urbani B, Youlatos D (eds) *Howler Monkeys. Developments in primatology: progress and prospects*. Springer, New York, NY
- WallisDeVries MF, Vries MFW, Bakker JP, Bakker JP, Van W (1998) *Grazing and conservation management*, vol 11. Springer Science & Business Media, New York
- Waters S, Bell S, Setchell JM (2018) Understanding human-animal relations in the context of primate conservation: a multispecies ethnographic approach in North Morocco. *Folia Primatol* 89(1):13–29
- White TG (1993) Evaluating conservation education programs at a South American zoo. MS thesis, University of Florida, Gainesville
- Wolfe LD, Fuentes A (2007) Ethno-primateology. Contextualizing human and nonhuman primate interactions. In: Campbell CJ, Fuentes A, MacKinnon K, Panger M, Bearder SK (eds) *Primates in perspective*. Oxford University Press, Oxford, pp 691–702
- Wu BQ (1993) Patterns of spatial dispersion, locomotion and foraging behaviour in three groups of the Yunnan snub-nosed langur (*Rhinopithecus bieti*). *Folia Primatol* 60:63–71
- Wu Z (2006) The areal-types of seed plants and their origin and differentiation. Yunnan Science and Technology, Kunming
- Xiang Z, Huo S, Xiao W (2010) Activity budget of *Rhinopithecus bieti* at Tibet: effects of day length, temperature and food availability. *Curr Zool* 56(6):650–659
- Yang J, He LF (2011) The totem worship and surnames of the Lisu ethnic group. *J Yunnan Univ Natl* 18:74–76 **(in Chinese with an English abstract)**
- You Z (1994) *Yunnan national history*. Yunnan University Press, Kunming (in Chinese)
- Zelezny LC (1999) Educational interventions that improve environmental behaviors: a meta-analysis. *J Environ Educ* 31:5–14
- Zhou M (2000) Language policy and illiteracy in ethnic minority communities in China. *J Multiling Multicult Dev* 21(2):129–148