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Perception and Attitudes of Local Communities Towards Wild Elephant-related Problems and Conservation in Xishuangbanna, Southwestern China

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Abstract: The problem of wild elephants, or human-elephant conflict (HEC), influences the daily life of local communities and hinders the conservation of wild elephants. The perception and attitudes of local communities who inhabited the frontiers between human activities and wild elephant movement are important to the mitigation of the HEC and conservation of wild elephants. To analyze the perception and attitudes of local communities, the Participatory Rural Appraisal (PRA) was used in the investigation of 423 interviewees from 22 villages in Xishuangbanna from July 2009 to February 2010. The results indicated that local communities had their views on the elephant-related problems. In field survey, we found that 66.5% of interviewees were willing to support, participate in, and assist in the conservation of wild elephants; 33.5% of interviewees were opposed or indifferent to such conservation, because their livelihoods and even their lives were endangered by wild elephants. These views and attitudes were influenced by local communities′ perception of HEC, education level, gender and self-interest. Therefore, it is necessary to analyze the diverse views among local communities and balance profits and costs in addressing HEC.
Keywords: human-elephant conflict (HEC); local community; participatory rural appraisal (PRA); Xishuangbanna

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1 Introduction

The Asian elephant (*Elephas maximus*) is classified as endangered under the revised International Union for Conservation of Nature (IUCN) Red List and is also one of the first class national protected animals in China (Wang and Xie, 2009; IUCN, 2010). The wild Asian elephants of China, with a population estimated at 200–250 individuals, are distributed currently in separate areas of Xishuangbanna, Lincang and Puer in Yunnan Province (Chen *et al.*, 2006). But human-elephant conflicts (HEC) have reached crisis level. A total of 120 wild Asian elephants were poached illegally during 1966–2005, and 32 people have died in wild elephant attacks from 1991 to 2010 (Wu, 2008). HEC, referring to a range of direct and indirect confrontations between people and elephants, have been widely reported throughout Africa and Asia (Hoare and Du Toit, 1999; O′Connell-Rodwell *et al.*, 2000; Steinmetz *et al.*, 2006; Sukumar, 2006). Ways to mitigate HEC were discussed, for example, scaring away wild elephants by visual, auditory or olfactory means, barring them from farming fields with electric fences and concrete walls, and providing planted food resources and salt ponds for elephants in remote areas (Zhang and Wang, 2003; Wu, 2008). But efficiency is poor (Wu, 2008). Of many causes, the lack of local community participation is the key one (Steinmetz *et al.*, 2006; Li *et al.*, 2009).

Local communities confront wild elephant movement. The people′s perception, attitudes and practices are important for protecting wild elephants and mitigating of HEC. In Sri Lanka, for example, the communal cohe-

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siveness of crop protection among farmers has been more successful than individual defenses (Fernando *et al*., 2005). Local people, protected-area staff, and conservation biologists have cooperated in problem solving for large animal conservation (Steinmetz *et al*., 2006). Therefore, studies on perception and attitudes of local communities towards wild elephant-related problems and conservation in Xishuangbanna are helpful for the mitigation of the HEC and conservation of wild elephants. The purposes of this study are to learn the perception and attitudes of local communities towards wild elephant-related problems and conservation, to analyze factors that influence communities′ consciousness or behavior, and to discuss key approaches to the conservation of wild elephants and the mitigation of HEC.

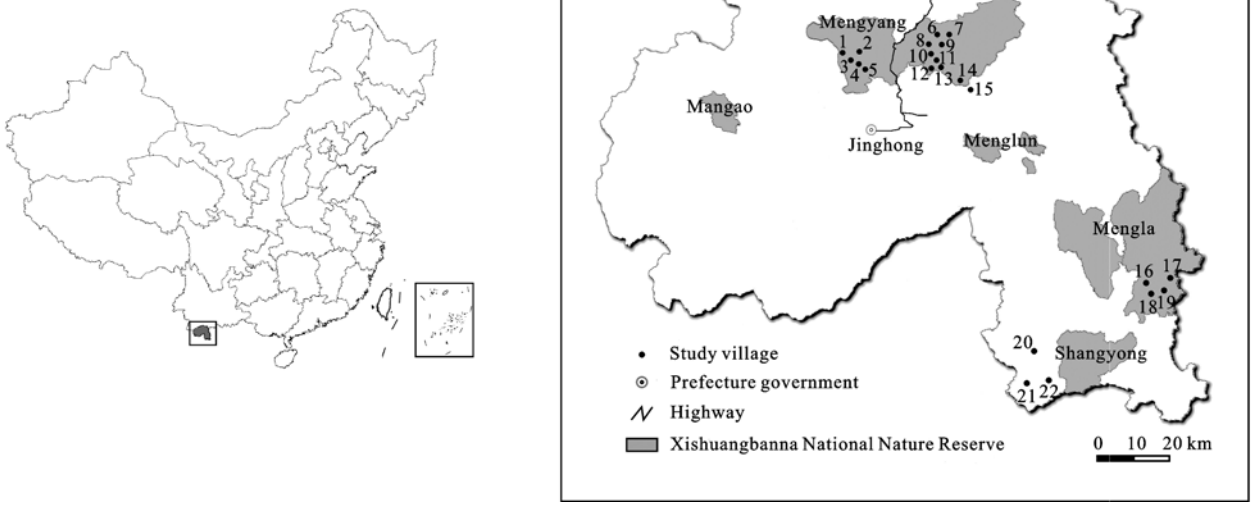
2 Materials and Methods

2.1 Study area

Xishuangbanna, a Dai Autonomous Prefecture, lies in the southern Yunnan Province and to the northwest of Laos and northeast of Myanmar. Xishuangbanna National Nature Reserve, with a total area of 242 510 ha, is composed of five separated sub-reserves, namely Mengyang, Menglun, Mengla, Shangyong and Mangao (Fig. 1). There were 260 villages with 51 545 inhabitants living in or close to the reserve in 2007 (Wu, 2008; Yang and Tang, 2008).

There are currently two large groups of wild elephants in Xishuangbanna. One is in the Mengyang sub-reserve; the elephants moved in areas of Mengyang, Dadugang of Xishuangbanna Prefecture and Nuozhadu and Cuiyun of Puer Prefecture. Elephants move seasonally along migration routes from east to west in the Mengyang sub-reserve, and sometimes go northwest to Dadugang of Xishuangbanna Prefecture and Nuozhadu and Cuiyun of Puer Prefecture. From April to September, they go out of the forested reserve and feed on paddy rice, corn and other crops in farmlands; from October to January, some of them disappear in the deep forests of the reserve and some roam around villages to feed in rubber plantations, tea gardens, crop fields and even vegetable gardens close to farmhouses. The pattern of elephant movement was changed when a highway was opened in the middle of the Mengyang sub-reserve in 2006. Blocked by the highway, the elephants stayed to the east of it, causing more troubles. For example, they roamed into Xiamancha village seven different times in 2008, making a great threat to the communities.

Another is in the Mengla and Shangyong sub-reserves; the elephants move in areas of Mengla, Mengman and Shangyong of Xishuangbanna, and sometimes they go



1. Jiangbian; 2. Daoxiaoqing; 3. Dahebian; 4. Yinzicun; 5. Jingsan; 6. Shangguokou; 7. Xiaopingzhang; 8. Xiamancha; 9. Dangpian; 10. Cicaitang; 11. Xinshan; 12. Xintianba; 13.Tiaobahe; 14. Xinlongshan; 15. Manwaxinzhai; 16. Mandan; 17. Nanlang; 18. Manlang; 19. Xiananlang; 20. Shangzhongliang; 21. Hetu; 22. Nanping

Fig. 1 Location of study area and study villages

to Namtha and Phongsali in Laos. Usually, they stayed in the triangle area of Nanping, Hetu and Shangzhongliang. In 2001, 70 elephants crashed into Nanping, damaged houses and barns, and destroyed all the crop fields. From August 2008 to February 2010, elephant flocks damaged 31 132 rubber trees and disturbed the daily life of communities in Hetu. When the traditional landuse changed, elephants in Shangyong sub-reserve and Phongsali, Laos crowed into the Mengla sub-reserve. After the creation of a large-scale sugarcane plantation in 2000, elephant flocks visited this area annually.

2.2 Methods and data collection

HEC has developed in the reserve and its surrounding areas in the past decades. 22 villages were chosen among the 260 villages in or close to the reserve as the study area (Fig. 1), where wild elephant-related problems have developed annually, becoming critical recently.

The Participatory Rural Appraisal (PRA) was used to analyze communities′ perception and attitudes to wild elephant-related problems and conservation. PRA, a method of ′hearing communities, learning and perceiving their needs and development with them′ (Liu, 2005), was widely used to analyze and estimate current situation and development planning of communities by informal interviews with inhabitants (Yu *et al.*, 2009). It was also used to study the change of species and landscape in rural areas (Wu, 1997). The investigation was carried out, from July 2009 to February 2010, with assistance of the reserve staff who had been working in the local communities for several years and well understood the situation of the studied communities. Following the investigation outline of every special theme prepared before, we talked with the interviewees around the theme, and got the views, attitudes, and aspirations from their respondents regarding the theme.

We then used questionnaires to collect data in detail. The questionnaire was divided into three parts: 1) the generality of communities and inhabitants, such as ethnic group, population, age, infrastructures, farming fields, income and expenditure; 2) the interviewees′ view as to the environment, resources, and development of the villages they lived in; and 3) the perception and attitudes towards wild elephant-related problems and conservation, including the causes of wild elephants approaching villages and making disturbances, ways to drive them away and mitigate HEC, and who were benefited in the conservation of wild elephants.

We received 423 questionnaires, of which 412 (97.4%) were valid. The generality of the interviewees was listed in Table 1.

Table 1 Generality of interviewees

Generality of interviewees		Number of interviewees
Age	18–29	59
	30–39	154
	40–49	150
	≥ 50	49
Gender	Male	350
	Female	62
School education level	College	2
	Senior high school	15
	Junior high school	175
	Elementary school	212
	Illiterate	8
Ethnic group	Jino	118
	Hani	84
	Yi	74
	Dai	51
	Bulang	50
	Han	21
	Yao	13
	Lahu	1

2.3 Data analysis

To analyze local communities′ perception and attitudes towards wild elephant-related problems, we compared interviewees′ views including causes of elephant-related problems, measures to mitigate HEC and attitudes towards conservation with Microsoft Office Excel 2003.

To analyze correlations among personal characteristic, knowledge, perception and attitudes towards wild elephant-related problems and conservation, we considered social factors including education level, gender and age and knowledge factors including communities′ knowledge regarding human-elephant relations, methods to manage elephant-related problems, and the benefits of mitigating HEC and protecting wild elephants. The influencing factors were grouped into four levels as listed in Table 2. The grouped data were analyzed in SPSS Statistics 17.0 with bivariate correlation analysis and multiple linear regression.

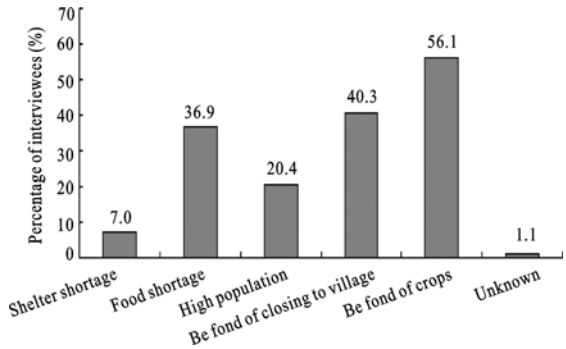
Table 2 Categories of factors influencing perception and attitudes of local communities towards wild elephant-related problems and conservation

Category	Levels			
	1	2	3	4
Causes of elephant-related problem	Shelter and food shortage	Attracted to village	Excessive population	Unknown
Methods to mitigate HEC	Planting food resources	Building obstacles	Expelling	Unknown
Coexistence with elephant	Indifferent	Impossible	Opposition	Unknown
Human-elephant relation	Very harmonious	Harmonious	Serious conflict	Unknown
Management of elephant-related problem	Absolute acceptance	Government′s business	Need to improve	Irrational
Protecting elephants	Support and participate in	Assist in	Care but not act	Care less
Beneficiary	State, community and individual	State and community	Individual	No benefit

3 Results and Analyses

3.1 Views of local communities on the elephant-related problems and mitigation of HEC

On the serious elephant-related problems, most of the interviewees believed that food was the key factor. They thought that edible wild plants were becoming scarce in the forested reserve but grew well in the human dominated habitats close to villages and farmlands, and that elephants were fond of crops (Fig. 2). As a result, elephants came close to villages and farmlands, making serious problems such as damage crops, houses and infrastructures, and even injure human.



Causes of wild elephant-related problems are multiple-choice

Fig. 2 Causes of wild elephant-related problems based on local communities′ perception

Local communities had different views on methods to mitigate HEC (Table 3). The most important methods were to separate wild elephants from humans with artificial obstacles and to scare them away by visual, auditory or olfactory devices. In the field survey, 43.0% of the interviewees considered planting food resources to be an effective way to reduce crop loss, but 35.7% of the interviewees thought it just worked well in the short terms. Planting food resources was criticized as a way of attracting elephants to take crops, which would result in more damage in the future. Only 4.4% of the interviewees considered land shortage as a problem. To the question, elephants and humans, who will occupy the lands after serious HEC, 69.6% of interviewees thought that the best way was to move the elephants away or cut down their population. Only 16.0% of them would consider moving out humans.

3.2 Attitudes of local communities towards conservation of wild elephants

Much work has been done to publicize and enforce laws and regulations for nature conservation and wildlife management since the establishment of the reserve in 1958. In general, local communities have understood the necessity and value of the conservation of wild elephants.

Of the 412 valid questionnaires, 274 interviewees (66.5% of the total) showed their intention to support and participate in, or at least assist in, the conservation of wild elephants (Table 4). More than half of the interviewees thought that the conservation of wild elephants was one of the national demands; they had no choice but to respond to it actively. About 8.5% of interviewees believed the conservation of wild elephants would benefit local communities; 5.1% expressed some pity for the wild elephants and actively supported their conservation.

The other 33.5% of interviewees showed indifference and opposition to the conservation of wild elephants. The main reason was that wild elephants often endangered their livelihoods and injured or even killed humans; they did not like to meet wild elephants in territory belonging to them.

3.3 Factors influencing perception and attitudes of local communities

We considered two groups of factors influencing the perception and attitudes of local communities towards the mitigation of HEC and the conservation of the wild elephant. One group was composed of social factors including education level, gender and age; another group was composed of knowledge factors including communities′ knowledge on human-elephant relation, methods of managing elephant-related problems, and the benefits of mitigating HEC and protecting wild elephants (Table 5).

The results indicated that education levels and gender were the main social factors influencing perception and attitudes of local communities towards the mitigation of HEC and conservation of wild elephant. Interviewees

Table 3 Measures to mitigate HEC based on local communities′ perception

	Methods of HEC mitigation	Number of interviewees	Percentage (%)
General methods	Fright	121	29.4
	Artificial isolation	266	64.6
	Guns	33	8.0
	Unknown	37	8.9
Planting food resources	Works well	177	43.0
	Efficient in a short term	147	35.7
	Changes food habits of elephants	73	17.7
	Shortage of land	18	4.4
Who will dominate the land	Inhabitants leave	66	16.0
	Elephants leave	230	55.8
	Reduction of rubber	42	10.2
	Reduction of elephants	57	13.8

Note: Four items in any method of HEC mitigation are multiple-choice

Table 4 Attitudes of local communities towards conservation of wild elephants

Attitudes	Reasons	Number of interviewees	Percentage (%)
Support, participate in and assist in	Meet the national demand	120	29.1
	Benefit local community	35	8.5
	Commiserate the elephants	21	5.1
	Have no choice	98	23.8
Care but not act, and indifferent	It is not an obligation of local communities	5	1.2
	Wild elephants endanger villages	122	29.6
	Wild elephants are useless	3	0.7
	Unwilling to say	8	1.9

Table 5 Correlativity of factors in perception and attitudes of communities towards elephant-related problems and conservation

Influence factors	Perception of elephant-related problems			Attitudes towards elephant conservation
	Causes of elephant-related problems	Methods to mitigate HEC	Coexistence with elephants	
Education level	–0.118*	0.130**	0.059	0.029
Gender	0.038	–0.052	0.153**	0.101*
Age	0.031	–0.030	–0.042	0.004
Human-elephant relation	–0.024	0.185**	0.381**	0.220**
Methods of managing elephant-related problems	–0.076	–0.024	0.205**	0.160**
Beneficiary	–0.006	0.083	0.207**	–0.240**

Note: *, ** denote 0.05 and 0.01 significance levels, respectively

who had got more school education understood well that the shortage of natural shelter and food was the key of elephant-related problems but they did not accept the methods of planting food resources and building obstacles to mitigate HEC. They preferred to expel wild elephants from where they lived currently. Men were more tolerant to the existence of elephants in their territory and were willing to participate in the conservation of wild elephants.

The results also indicated that all knowledge factors about elephant-related problems and conservation had significant effects on the perception and attitudes of local communities. The less the elephant-related problems arose, the more the interviewees accepted the possibility to co-exist with wild elephants and were willing to participate in conservation efforts. Interviewees agreed with the view that wild elephant conservation would benefit state, community and individuals, and if so, they would support and participate in conservation activities.

The stepwise regression analysis was applied to measuring the importance of human-elephant relations (x_1), methods of managing problem (x_2), benefits of conservation (x_3), and the communities′ will (Y) to conserve. The larger the absolute coefficient of x_i was, the more important was the x_i. The multiple linear regression equation was: $Y = 0.720 + 0.199x_1 + 0.103x_2 - 0.324x_3$, which meant that the benefit of wild elephant conservation was the most important factor influencing the communities′ will to conserve. They would support and participate in the conservation of wild elephants only if they received more benefits from the conservations. Harmonious relations between humans and elephants were also important.

4 Discussion

In the past 50 years, the related departments of the Chinese government, scholars, and non-governmental organizations have given much attention to the conservation of wild elephants and their habitats (Chen *et al.*, 2006; Wu, 2008). But the HEC became serious, making the conservation of wild elephants controversial. The management of the nature reserve has undergone the process of ′preservation-conservancy-management′, meaning the change from insulating protection to integrated management with the sustainable use of resources and development of local communities (Xu *et al.*, 2004), or change from technology-dominated to people-centered (Wainwright and Wehrmeyer, 1998). The participation of local communities in wildlife conservation was discussed throughout the world. Usually, wildlife conservation and local community development are closely related with the population density, behavior and food availability of wildlife, the composition and distribution of crops and livestock (Rao *et al.*, 2002), the perception and attitudes of local communities, regional human activities (Sun *et al.*, 1998; Chen *et al.*, 2006), and social economy and policy (Nyhus and Tilson, 2004). The development of the nature reserve should gain the support and approval of local communities.

Local communities are the main fresh combatants for the conservation of wild elephants. Results of this study indicated that more than half of interviewees were willing to support, participate in, or at least assist in the conservation of wild elephants Therefore, it is necessary to analyze the diverse views among local communities to make good decisions for nature conservation. Similar results were reported earlier. For example, the difference between gender, age, occupation, cultural background, led to more differences between interests and attitudes towards nature conservation in the communities (Agrawal and Gibson, 1999). Public activities did not threaten the restoration of wolf in Sweden, but to stabilize the population of wolves, residents and hunters needed to be educated to change their attitudes (Ericsson and Heberlein, 2003). Based on the clear differences in the perception of nature reserve management among different ethnic groups with different social features, the correct formulation and effective implementation of policy could not leave out public participation in the Wolong Nature Reserve in China (Xu *et al*., 2004). In regions containing wild elephants throughout Africa and Asia, local communities have been regarded as the main force of wild elephant conservation. However, local communities have suffered great economic loss and security threats from elephants, resulting in their hostility to elephants and, to a certain extent, obstructing conservation efforts (Naughton-Treves, 1998). The serious HEC dampened the enthusiasm of the communities in wild elephant conservation (Naughton-Treves, 1997). In India, for example, the serious HEC have led to ineffective conservation policies (Madhusudan, 2003).

It was found in this study that the local communities had their views on the cause of elephant-related prob-

lems. They believed shelter and food shortage were the key factor causing the elephant-related problems but imputed increasing problems to food shortages. They did not accept the fact that forests, wetlands and other habitats used by elephants 30–50 years ago were taken over to plant rubber, tea, sugarcane and other crops. Faced with serious elephant-related problems, they did not make any concessions. In fact, habitat degeneration due to expansion of cultivated land was the basic cause of elephant-related problems (Tchamba, 1996; Sukumar, 2006). In the current distribution areas of wild elephants in China, the proper habitats of wild elephants have been converted to cultivated land (Lang *et al.*, 2008; Li *et al.*, 2008).

The local communities were enthusiastic about the mitigation of HEC. Their views were to separate wild elephants from humans with some artificial blocks and to expel wild elephants. Electric fences and planting food resources were considered as better methods. Electric fences worked well initially but became useless later due to poor maintenance and repair. The cost of building electric fences was especially high in developing countries (Thouless and Sakwa, 1995). Local communities believed that planting food resources on the fringes of the reserve could work well for a short period of time but were worried that it would change feeding habits, leading to more damage in the future. In Xishuangbanna, linking the separated sub-reserves together by the construction of biological corridors was believed to be a better way to mitigate the HEC (Lin *et al.*, 2006), but it was necessary to understand the perception and attitudes of local communities and to gain more support and participation from them (Li *et al.*, 2009).

5 Conclusions

Wild elephants endangered livelihoods and even lives of local communities that inhabited the frontiers between human activities and wild elephant movement in Xishuangbanna, China, making human-elephant conflicts reach crisis level. To the serious elephant-related problems, local communities did not make any concessions because they did not accept the fact that human occupied the habitats previously used by elephants, although they cared about HEC mitigation. On another hand, to the conservation of wild elephant, 66.5% of interviewees were willing to support, participate in, and assist in, but 33.5% of them were opposed or indifferent to such conservation. The main causes for such views and attitudes were local communities′ perception of HEC, education level, gender and self-interest. Therefore, how to balance the profits and cost for the mitigation of HEC and the conservation of wild elephants in Xishuangbanna is the key factor influencing local communities′ perception, attitudes, support and participation.

Two suggestions were put forward for the mitigation of HEC in the future: 1) pay more attention to public education in terms of coexistence between human and elephants at the community level; 2) partial concessions must be made by withdrawing human inhabitants and agricultural cultivation from where wild elephant-related problems have recently arisen.

In addition, local communities were sensitive to pecuniary matters. It was difficult to get accurate data about income, expense and pecuniary loss due to elephant-related problems. Ecological compensation for the elephant conservation effort should be considered in the future.

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