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Residents' attitudes toward reintroduced sika deer in Kenting National Park, Taiwan

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Hunting and habitat loss led to the extinction of the Formosan sika deer *Cervus nippon taiouanus* population in the wild in 1969. A sika deer restoration program has been in place in Kenting National Park (KTNP), Taiwan since 1984. Human–deer conflicts have increased following wild deer population growth. Understanding residents' attitudes toward reintroduced sika deer is vital to management policies. To investigate the local residents' attitudes, we collected 228 questionnaires through personal interviews in 2010. A majority of the respondents agreed that they would be happy to encounter a wild sika deer (78.1%), and a majority supported the restoration program in the KTNP (75.4%). However, 59.1% of the respondents knew little concerning the restoration program. Approximately half of the respondents (47.8%) thought that sika deer caused damages to crops, and 18.4% of the respondents actually suffered crop damages from deer. The farmers and people living within the deer's range were more vulnerable to deer damage; therefore, they were more aware of deer damage to their crops and livelihoods than non-farmers and people living outside of the deer's range. In addition, most respondents (87.2%) considered sika deer as an attractive tourism resource and were supportive of the development of ecotourism (87.3%). We recommend that the KTNP should improve public participation, environmental education, and communication with the local people. The development of community-based ecotourism would increase the benefits of the reintroduction of sika deer and would help to mitigate human–deer conflicts.

Human–wildlife conflict is an important wildlife conservation and management issue that involves many species and situations, such as rodents eating stored food, herbivore damage to crops, carnivore attacks on livestock or humans, vehicle collisions and disease transmission (Treves et al. 2009, Dickman 2010). Conover (1998) examined the perceptions regarding wildlife held by US agricultural producers and observed that most respondents (80%) suffered wildlife damage and 54% of the respondents reported > 500 USD in losses annually. Deer are often involved in human–wildlife conflicts when their population size is overabundant (Côté et al. 2004). Deer behaviors including foraging, bark stripping and antler rubbing may cause the death of trees and seedlings, create economic loss from crop destruction, and change the plant community structure and succession rates (Côté et al. 2004, Takatsuki 2009). In the USA and Hokkaido, Japan, the annual financial costs of deer damage on agriculture and forestry were estimated to be more than 850 million (Conover 1997) and 50 million (Takatsuki 2009) USD, respectively. To reduce deer damage to forestry and agriculture, approximately 80 000 sika deer are hunted and culled in Hokkaido every year (Takatsuki 2009).

Natural resource managers are increasingly concerned with integrating residents' attitudes into wildlife policies. In general, people have a positive attitude toward rare and endangered species and support their restoration (Kellert et al. 1996, Williams et al. 2002, Heberlein and Ericsson 2008). However, people with the most positive attitudes have been those with the least experience with wildlife (Williams et al. 2002). In comparison, suburban residents, who are more likely to be impacted by wildlife, usually have more negative attitudes toward wildlife (Hunziker and Wallmer 1998, Kvaalen 1998, Heberlein and Ericsson 2008). In addition, attitudes toward wildlife may differ among social groups (Williams et al. 2002, Røskaft et al. 2007). For example, farmers tend to prefer lethal methods to control wildlife (McIvor and Conover 1994), and ranchers and hunters usually oppose the reintroduction of large carnivores (Hunziker and Wallmer 1998, Kvaalen 1998, Chavez et al. 2005). In communities where wildlife tourism is developed, people exhibit stronger associations with conservation behaviors and perspectives after participating in training sessions and receiving benefits from tourism (Sekhar 2003, Stem et al. 2003, Blackie 2006, Mbaiwa and Stronza 2011).

The Formosan sika deer *Cervus nippon taiouanus*, which has been a highly valued animal resource to humans, was widely distributed in the low-elevation areas of Taiwan in the past. Its meat was an important food resource to indigenous people, and a record 110 000 skins per year were exported to Japan in the 17th century (Chiang 1987, McCullough 2009). As a result of hunting and habitat exploitation, this subspecies became extinct in the wild in 1969 (McCullough

1974). The Formosan sika deer restoration program has been in place in Kenting National Park (KTNP) since 1984, and sika deer have been reintroduced to the KTNP and nearby areas since 1994 (Pei 2009). According to a survey in 2010, a wild sika deer population of more than 1000 deer has been successfully established (Yen et al. 2012).

As the sika deer population size increases and the distribution range expands, human–deer contacts and conflicts become more frequent. Wang et al. (2009) showed that the proportion of farmers incurring deer damage increased annually in the KTNP and nearby areas. In addition, there were eight cases of agriculture damage formally reported to the headquarters of KTNP since 2011. The loss of each case ranged from 2000 to 30 000 USD (Headquarters of KTNP unpubl.). Understanding how residents perceive sika deer could help wildlife managers develop management plans that conserve sika deer and alleviative conflicts.

This study is a case of human–wildlife conflict after a reintroduction program of a deer population in a protected area where human settlements exist. The objectives of this study were to investigate residents' attitudes about sika deer, deer damage, the restoration program, and ecotourism. Attitudes were compared between farmers and non-farmers and between people living within the deer's distribution range and those living outside but close to the range. We expected that farmers, who are more vulnerable to deer damage, would express more negative attitudes than non-farmers. The comparison between residents living outside and within the deer range would reflect that peoples' attitudes change before and after the deer become neighborhood wildlife. If their attitudes differ, obviously, the KTNP should improve two-way communication with those outside of the deer's range because they are those who are likely to encounter deer problems in the near future. In addition, because ecotourism is one possible method for alleviating human–-deer conflict, attitudes toward ecotourism by local people (particularly farmers who may suffer monetary loss) would be important information for the KTNP wildlife managers to possess.

Material and methods

Study area

The study area is located in southern Taiwan, including the KTNP and nearby areas (Fig. 1). The administrative districts of our study area include the Hengchun and Manchou townships, which comprise 25 villages and a population size of approximately 40 000 people (<29 years old: 35.7%, 30–49 years old: 31.8%, >50 years old: 32.4%) (Pingtung County Government 2010). Approximately 8000 residents are farmers (National Statistics Taiwan 2010), and the major crops are fruit trees, herbs, vegetables, rice and corn. The KTNP was established in 1982. After its establishment, conflicts between the local residents and KTNP occurred frequently because agricultural activities were confined to private lands, the extension of residential construction was prohibited, and hunting, gathering and fishing were banned. The terrestrial range of the KTNP is 181 km^2, of which approximately 5% includes human settlements and 20% is comprised of farms.

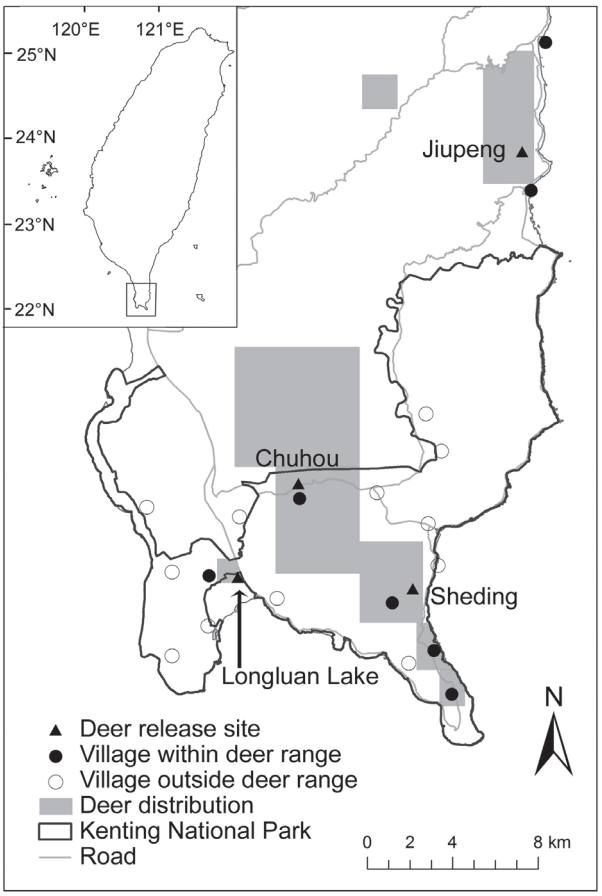

Figure 1. Map of Kenting National Park and nearby areas showing the deer-release sites and the villages surveyed.

There were four release sites for the reintroduction of sika deer: Sheding, Chuhuo, Longluan Lake and Jiupeng (Fig. 1). Although there are large forested areas considered to be potential habitats for sika deer located outside the range of the national park, the sika deer does not currently reside in all potential habitats. In addition, the relative abundance of the wild sika deer population varies in its distribution range because of human settlement blocks and poaching pressure (Wang et al. 2009, 2010, Yen et al. 2012). The population density outside the range of the national park was lower (conservatively estimated as approximately 2 deer km^{-2}) than inside the national park (11.4–26.7 deer km^{-2}), which is possibly a result of the different levels of poaching pressure (Yen et al. 2012). However, there are no official records of deer harvest.

In recent years, the KTNP developed community-based ecotourism in some communities, such as Sheding community, with deer-watching being one of the primary attractions. The communities involved had population sizes of approximately one to two hundred people. Most of the residents in these communities were relatively economically disadvantaged because of a lack of industry and commerce. The KTNP and a team from Pingtung University of Science and Technology designed the ecotourism service and trained local residents as guides through classroom

instruction and outdoor practice (Chen et al. 2007). The residents provided all the tourism services for visitors and gained all the economic benefits from visitors' payments. Residents also were responsible for natural resource monitoring and had the opportunity to participate in its management with the KTNP (Chen et al. 2010).

Sample and survey methodology

Questionnaires were completed through personal interviews during May and June 2010. We spent a total of 30 days conducting this survey. One of the authors, K.-H. Chen, conducted all the interviews with the help of two assistants. We visited seven villages within the deer distribution range and 12 villages outside yet close to the range. We did not survey another two villages within the distribution range because of time constraints. We conducted convenience sampling (Weathington et al. 2010) by walking around the villages and talking to people we met and by going door to door. In smaller villages, all houses were visited, whereas houses in larger villages were randomly selected. We only interviewed one representative person per household. The survey was conducted both during the day and at night, and on weekdays and weekends, to reduce sampling bias. Because a large portion of the residents were old or had lower education levels (below high school), we often verbally explained the questionnaire items to ensure understanding of the questions.

We divided the respondents into a farmers group and a non-farmers group to examine how their attitudes differ. Farmers (24.1%) were those who received income from the sale of crops, and those who had no other job except for cultivating crops (e.g. a retired person who cultivates crops for self-use). Non-farmers (75.9%) were those who did not cultivate crops, and those who grew plants for self-use but had another source of income. In addition, the respondents were divided into two separate groups: residents within the deer distribution range (58.3%) and residents outside of the range (41.7%; Fig. 1). Classification was based on the deer distribution range delineated by the study of Yen et al. (2012). It should be noted that the group that is currently outside of the deer range will likely be exposed to deer in their neighborhoods in the near future because the deer range keeps expanding.

Questionnaire design

Our questionnaire originated from the questionnaire of Chen et al. (2003), which examined residents' attitudes toward sika deer during the early period of reintroduction. We deleted some items that were irrelevant to this study and redesigned other items according to our field experience. Then, we consulted with a biologist who is acquainted with the restoration program and a scholar with a social science background to confirm the validity of our questionnaire. A pilot survey with 22 samples was conducted. Finally, the questionnaire, which originally had 42 items, was refined to include 20 items covering the residents' attitudes across four dimensions: sika deer, deer damage, the restoration program, and ecotourism (Table 1). Two true/false items were used to test the respondents' knowledge and experience concerning the subjects: 1) did you know that the Formosan sika deer were previously extinct in the wild?; and 2) have you ever seen a wild sika deer? Other questions in the survey concerning respondents' attitudes adhered to a 5-point Likert scale: [1] = strongly disagree, [2] = disagree, [3] = neutral, [4] = agree, and [5] = strongly agree (Likert 1932).

Data analysis

Data were analyzed using SPSS 19.0. Descriptive statistics were used to represent the public attitudes of the residents. A two-sample t-test was used to test the null hypothesis that the responses did not differ between farmers and non-farmers and between residents within and outside of the deer range (p-values of < 0.05 were considered to be statistically significant).

Results

Demographic characteristics of respondents

A total of 244 respondents were contacted and 16 of them declined to participate, resulting in a response rate of 93.4%. Approximately half of the respondents (51.8%) were over 50 years old, 36.4% were middle-aged (30–49 years old), and 11.8% were young (29 years old and younger). The ratio of males to females was 64:36. 8.7% of the respondents had at least a college education, 51.7% had completed junior high school or senior high school, and the remainder (38.6%) had completed or dropped out of elementary school.

Local attitudes toward sika deer, deer damage, restoration program and ecotourism

The results showed that 52.2% of the respondents were aware that the Formosan sika deer had previously been extinct in the wild, and 42.5% of the respondents had never seen a wild sika deer. A majority of the respondents strongly agreed or agreed that they would be happy to encounter a wild sika deer (78.1%), and a majority thought that it is wonderful to have sika deer in Taiwan (91.0%; Table 1). Only 11.4% of the respondents said that they would be afraid to encounter a wild sika deer. Regarding intended behavior, approximately half (50.9%) of the respondents would like to share their comments on sika deer management, and a majority (72.8%) would help a deer that had suffered a dog attack.

Residents of the KTNP and nearby areas had a variety of concerns regarding deer damage, particularly damage to crops and deer–car collisions (Fig. 2). Approximately half of the respondents (47.8%) strongly agreed or agreed that sika deer damage crops and a minority (30.4%) thought that damage by deer harms residents' livelihoods (Table 1). However, only a minority of the respondents (18.4%) had actually suffered deer damage. The damaged crops included fruit trees (10.9%), sweet potatos (9.2%), herbage (7.0%), and other crops (5.3%). The most serious impacts might occur on grassland farms because some wholesalers would reject to purchase the herbage if it contained deer fecal

Table 1. Responses by the residents (n = 228) of Kenting National Park and nearby areas to statements reflecting the attitudes toward the reintroduced sika deer. Data were collected in 2010.

Attitude dimension statement	Percent responses				
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Sika deer					
I would be happy if I encountered a wild sika deer	3.5	4.8	13.6	28.1	50.0
It is wonderful to have sika deer in Taiwan	1.4	1.8	5.9	35.3	55.7
I would be afraid if I encountered a wild sika deer	68.0	17.5	3.1	8.3	3.1
I would like to share my comments on sika deer management	2.2	16.7	30.7	35.1	15.4
If I encountered a dog attacking a sika deer, I would try to help the deer	3.1	12.5	11.6	30.4	42.4
Deer damage					
Reintroduced sika deer cause damages to crops	20.6	16.2	15.4	28.1	19.7
Deer damages harm residents' livelihoods	26.9	25.6	17.2	20.3	10.1
Sika deer have caused negative impacts on my crops or property	57.9	14.5	9.2	11.8	6.6
Deer damage to crops should be compensated by the government	2.2	9.3	14.7	38.2	35.6
Restoration					
Sika deer have the right to live in the wild	0.9	7.5	6.1	46.5	39.0
I support the sika deer restoration program in KTNP	1.8	4.1	18.7	47.5	27.9
I know the details of the sika deer restoration program in KTNP	25.3	33.8	8.9	23.6	8.4
The reintroduced sika deer may have negative impacts on native fauna or flora	12.1	41.7	22.9	19.3	4.0
I am willing to take concrete action to help the restoration of sika deer	9.2	32.9	16.2	28.5	13.2
Ecotourism					
The sika deer can be an attractive tourism resource	1.3	5.8	5.8	44.7	42.5
I support the development of deer-watching tourism in Kenting	1.8	4.0	7.0	43.2	44.1
The restoration of sika deer is beneficial to conservation and environmental education	2.2	8.8	8.4	35.7	44.9
I am willing to participate in a training course on ecotourism services	9.3	35.7	10.6	28.6	15.9

matter. In addition, most respondents (83.8%) believed that damages from deer should be compensated by the government.

A majority of the respondents agreed that sika deer have the right to live in the wild (85.5%) and supported the restoration program in the KTNP (75.4%; Table 1). However, 59.1% of respondents had little knowledge of the restoration program. Furthermore, less than half of the respondents (41.7%) were willing to take action to help restore the sika deer population.

Most respondents (87.2%) considered the sika deer to be an attractive tourism resource (Table 1). Overall, respondents were supportive of the development of ecotourism (87.3% of respondents) and believed that the restoration of sika deer is beneficial to environmental education (80.6% of respondents). When asked about their intention to participate in an ecotourism training course, 44.5% of the respondents expressed interest in doing so.

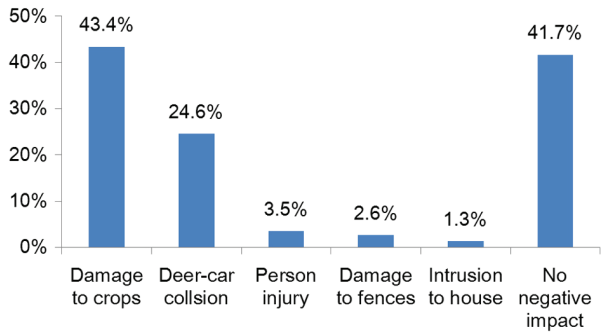

Figure 2. Deer-related concerns by residents (n = 228) of Kenting National Park and nearby areas. Data were collected in 2010. The sum is greater than 100% because the respondents could select more than one choice.

Comparison between farmers and non-farmers

The results shown in Table 2 indicate that both farmers and non-farmers had positive attitudes toward sika deer. However, farmers had less positive attitudes regarding the statement, "It is wonderful to have sika deer in Taiwan" ($p = 0.018$) and were more willing to share their comments concerning deer management ($p = 0.040$). Striking differences were observed between farmers and non-farmers in their impressions of deer damage. Farmers were more aware of deer damage to crops ($p < 0.001$) and more likely to believe that deer damage harms residents' livelihoods ($p = 0.001$). In addition, farmers were more likely to actually suffer negative impacts by deer ($p < 0.001$). Although both farmers and non-farmers tended to agree that deer have the right to live in the wild ($p = 0.104$), the attitudes of non-farmers were more positive than those of the famers toward the deer restoration program in the KTNP ($p = 0.002$). The two groups both had positive attitudes toward ecotourism statements, without significant difference.

Comparison between residents within and outside the deer range

Residents living both within and outside of the deer distribution range had highly positive attitudes toward sika deer,

Table 2. Comparison of attitudes toward the reintroduced sika deer between farmers (n = 55) and non-farmers (n = 173) and between residents living within (n = 133) and outside (n = 95) of the deer distribution range using Likert response scores (1 = strongly disagree, 5 = strongly agree) for Kenting National Park and nearby areas, 2010.

Attitude dimension statement	Farmer (mean ± SD)	Non-farmer (mean ± SD)	T	p	Within deer range (mean ± SD)	Outside of deer range (mean ± SD)	T	p
Sika deer								
I would be happy if I encountered a wild sika deer	4.00 ± 1.07	4.21 ± 1.05	−1.306	0.193	4.16 ± 1.09	4.17 ± 1.03	−0.074	0.941
It is wonderful to have sika deer in Taiwan	4.19 ± 0.86	4.49 ± 0.76	−2.388	0.018	4.43 ± 0.83	4.41 ± 0.76	0.194	0.847
I would be afraid if I encountered a wild sika deer	1.69 ± 1.14	1.58 ± 1.07	0.638	0.524	1.59 ± 1.09	1.63 ± 1.08	−0.258	0.797
I would like to share my comments on sika deer management	3.69 ± 1.03	3.37 ± 1.00	2.064	0.040	3.50 ± 1.09	3.37 ± 0.89	0.996	0.320
If I encountered a dog attacking a sika deer, I would try to help the deer	3.78 ± 1.27	4.02 ± 1.11	−1.369	0.172	4.06 ± 1.12	3.83 ± 1.19	1.491	0.138
Deer damage								
Reintroduced sika deer cause damages to crops	3.84 ± 1.38	2.87 ± 1.37	4.553	< 0.001	3.44 ± 1.33	2.63 ± 1.44	4.338	< 0.001
Deer damages harm residents' livelihoods	3.13 ± 1.43	2.45 ± 1.27	3.347	0.001	2.90 ± 1.32	2.21 ± 1.26	3.954	< 0.001
Sika deer have caused negative impacts on my crops or property	2.76 ± 1.63	1.69 ± 1.09	5.608	< 0.001	2.08 ± 1.36	1.76 ± 1.24	1.842	0.067
Deer damage to crops should be compensated by the government	4.19 ± 1.03	3.88 ± 1.03	1.874	0.062	4.02 ± 1.00	3.86 ± 1.08	1.149	0.252
Restoration								
Sika deer have the right to live in the wild	3.98 ± 0.95	4.21 ± 0.88	−1.631	0.104	4.09 ± 0.95	4.24 ± 0.82	−1.259	0.209
I support the sika deer restoration program in KTNP	3.62 ± 0.88	4.05 ± 0.87	−3.074	0.002	3.94 ± 0.96	3.98 ± 0.78	−0.318	0.751
I know the details of the sika deer restoration program in KTNP	2.79 ± 1.25	2.49 ± 1.34	1.472	0.143	2.78 ± 1.4	2.25 ± 1.13	3.040	0.003
The reintroduced sika deer may have negative impacts on native fauna or flora	2.63 ± 1.00	2.61 ± 1.07	0.101	0.920	2.65 ± 1.11	2.57 ± 0.98	0.532	0.595
I am willing to take concrete action to help the restoration of sika deer	2.93 ± 1.23	3.07 ± 1.23	−0.745	0.457	3.11 ± 1.29	2.93 ± 1.14	1.129	0.260
Ecotourism								
The sika deer can be an attractive tourism resource	4.13 ± 1.03	4.24 ± 0.84	−0.784	0.434	4.30 ± 0.89	4.10 ± 0.88	1.671	0.096
I support the development of deer-watching tourism in Kenting	3.91 ± 1.13	4.19 ± 1.00	−1.770	0.078	4.09 ± 1.11	4.17 ± 0.93	−0.555	0.579
The restoration of sika deer is beneficial to conservation and environmental education	4.05 ± 0.93	4.3 ± 0.86	−1.783	0.076	4.3 ± 0.83	4.16 ± 0.95	1.162	0.246
I am willing to participate in a training course on ecotourism services	2.82 ± 1.42	3.14 ± 1.23	−1.620	0.107	2.98 ± 1.35	3.17 ± 1.19	−1.062	0.289

without significant differences (Table 2). Residents within the deer range agreed more strongly that the sika deer may cause damage to crops ($p < 0.001$) and harm residents' livelihoods ($p < 0.001$). However, both groups tended to disagree that deer had caused damage to their own crops or property. The two groups both had favorable attitudes toward the restoration program. For the statement, "I know the details of the sika deer restoration program in KTNP," respondents within the deer range had a higher mean score (2.78) than those outside of the deer range (2.25; $p = 0.003$). In addition, in both groups, the respondents held positive attitudes toward ecotourism.

Discussion

The sika deer restoration program has been operating in the KTNP for approximately 30 years. However, most residents had little knowledge of the program. Only half of the respondents (52.2%) knew that sika deer had previously been extinct in the wild. Two thirds of the respondents (68.0%) did not know the details of the restoration program (Table 1). During our personal interviews with the local residents, we found that many residents did not realize the reasons for the restoration program and the concepts of conservation. In addition, our results suggested that the attitudes of residents outside of the deer distribution range implied less awareness of possible deer damage and less knowledge of the restoration program (Table 2). We recommend the KTNP increases its communication with local residents and shares knowledge and information about the ecological significance and current situation of the sika deer restoration efforts via environmental education activities, such as conservation summer camps, ecological film screenings, and forums or expert lectures. The villages outside yet nearby the deer range must be involved because the deer population size and range is expanding. As knowledge and understanding increases, the support of residents concerning restoration and conservation policies should also increase (Mehta and Heinen 2001, Howe et al. 2012, Schumann et al. 2012).

In general, the residents were found to be fond of sika deer and agreed that deer have the right to live in the wild

(Table 1). However, the farmers typically had less positive attitudes regarding sika deer than the non-farmers (Table 2). These results support our expectation that people who are more vulnerable to human–deer conflicts would have less favorable attitudes to the reintroduction of sika deer. Similar results were found in previous studies; for example, ranchers in Arizona who incurred monetary losses from elk damage wanted to keep all elk off their land (Heydlauff et al. 2006); and Virginia residents experiencing severe damage were more likely to support dramatic reductions in deer herds (West and Parkhurst 2002). However, we noticed that the mean attitude scores of farmers were only slightly lower than neutral when addressing issues about deer damage (2.76) and the mean score still indicated that farmers tended to support the restoration program (3.62) (Table 2). These results suggest that the farmers had suffered negative impacts by deer, but the situation was not severe at the time of the study.

We found a discrepancy between the residents' perceptions of damage and the actual degree of damage according to the questionnaire (Table 1, the first three items of the deer damage dimension) and our observations at each location. Such disproportionate responses often underlie other social factors such as conflicts between authorities and local residents (Dickman 2010). During our interview process, the respondents often complained about the KTNP regardless of our questionnaire. We hypothesize that the residents' anger at deer damage was amplified because their resentment with the leadership of the KTNP was transferred to the sika deer. Similar cases have been discussed in the literature (Naughton-Treves and Treves 2005, Skogen et al. 2008). We recommend that the KTNP create more opportunities for public participation in their management, for example, hold a symposium before the next deer release event. Public participation would be an effective way to increase tolerance and reduce conflicts (Treves et al. 2009). In addition, Dickman (2010) considered education one of the best ways to resolve this type of conflict. The long-term influence of education would mitigate the tense relationship between authorities and local people, and would lessen the residents' hostility to wildlife (Prokop et al. 2009).

Our results showed that most respondents believed deer damage should be compensated by the government (Table 1). Although financial compensation by the government is common in many places, it would be unfeasible in this case because sika deer in Taiwan have the status of livestock and not wildlife; therefore, there is no suitable law for damage compensation in this situation. Furthermore, some of the farms were not private and some were outside of the KTNP; thus, it is difficult to evaluate whether these cases qualify to receive compensation. In addition, culling is a method often adopted to address problematic animals (Kaji et al. 2010). However, it is not feasible in current circumstances for several reasons: 1) the size of this Formosan sika deer population is relatively small and is the only population that exists in its native range; 2) sika deer currently have little economic value in Taiwan. There is no market for or habit of exploiting sika deer by the general public; 3) sport hunting is not permitted under law, and the law for culling problematic animals is not mature in Taiwan; and 4) people in Taiwan usually feel uncomfortable about taking a life because of Buddhist beliefs and the increase in animal rights.

Increasing the benefits of wildlife could mitigate human–wildlife conflicts (Heberlein and Ericsson 2008). We suggest that increasing the benefits of sika deer through the development of community-based ecotourism would be an applicable approach. The success of developing ecotourism and the collaborative management of natural resources in the Sheding community provides a good precedent (Chen et al. 2007, 2010). Several studies have suggested that the benefits of wildlife or ecotourism improve local people's attitudes toward wildlife and conservation areas (Mehta and Heinen 2001, Sekhar 2003, Mbaiwa and Stronza 2011). Our results show that 87.3% of the respondents supported the development of ecotourism, and 87.2% considered sika deer an attractive tourism resource. Even the vulnerable residents, i.e. the farmers and those living within the deer distribution range, were highly supportive of the development of ecotourism (Table 2). Thus, we believe that the proper development of ecotourism would be effective at increasing local benefits and mitigating human–deer conflicts. Furthermore, the tense relationship between the administration of the KTNP and the local people might be alleviated. In addition, the educational function of the national park could be achieved through a meaningful tourism experience.

In a review of the literature we found some approaches, other than environmental education, public participation, and ecotourism, that might be feasible in the KTNP and nearby areas (Hygnstrom and Craven 1988, Osborn and Parker 2002, Treves et al. 2009, Dickman 2010, Allendorf et al. 2012): 1) providing subsidies to install fences; 2) teaching farmers to use acoustic or visual repellents, for example, a dog barking playback; 3) testing chemical repellents (odor or taste repellents); 4) collaborating in agriculture with farmers, for example, authorities can provide fertilizer or lend agricultural machinery to farmers to reduce their costs, and farmers can offer some crops for deer in return. No approach is perfect; for example, fences may fragment deer habitats, and repellents may disturb wildlife. Actions should be selected and adjusted according to local conditions.

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References

Allendorf, T. D. et al. 2012. Using residents' perceptions to improve park–people relationships in Chatthin Wildlife Sanctuary, Myanmar. – J. Environ. Manage. 99: 36–43.

Blackie, P. 2006. Is small really beautiful? community-based natural resource management in Malawi and Botswana. – World Dev. 34: 1942–1957.

Chavez, A. S. et al. 2005. Attitudes of rural landowners toward wolves in northwestern Minnesota. – Wildl. Soc. Bull. 33: 517–527.

Chen, M. H. et al. 2007. Study on Sheding ecotourism development in Kenting National Park. – Headquarters of Kenting National Park, Pingtung, Taiwan, in Chinese with English abstract.

Chen, M. H. et al. 2010. The program of nature resource management and partnership development between Sheding

community and Kenting National Park. – Headquarters of Kenting National Park, Pingtung, Taiwan, in Chinese with English abstract.
Chen, Y. C. et al. 2003. Formosan sika deer (*Cervus nippon taiouanus*) population monitoring in Kenting National Park and vicinity area. – Headquarters of Kenting National Park, Pingtung, Taiwan, in Chinese with English abstract.
Chiang, S. S. 1987. The relationship between sika deer and early Taiwan history. – In: Wang, Y. (ed.), The 1985 annual report of the Formosan sika deer restoration study. – Headquarters of Kenting National Park, Pingtung, Taiwan, pp. 2–24, in Chinese.
Conover, M. R. 1997. Monetary and intangible valuation of deer in the United States. – Wildl. Soc. Bull. 25: 298–305.
Conover, M. R. 1998. Perceptions of American agricultural producers about wildlife on their farms and ranches. – Wildl. Soc. Bull. 26: 597–604.
Côté, S. D. et al. 2004. Ecological impacts of deer overabundance. – Annu. Rev. Ecol. Evol. Syst. 35: 113–147.
Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. – Anim. Conserv. 13: 458–466.
Heberlein, T. A. and Ericsson, G. 2008. Public attitudes and the future of wolves *Canis lupus* in Sweden. – Wildl. Biol. 14: 391–394.
Heydlauff, A. L. et al. 2006. Perceptions regarding elk in northern Arizona. – Wildl. Soc. Bull. 34: 27–35.
Howe, C. et al. 2012. Evaluating the effectiveness of a public awareness campaign as a conservation intervention: the saiga antelope Saiga tatarica in Kalmykia, Russia. – Oryx 46: 269–277.
Hunziker, M. E. and Wallmer, E. 1998. Return of predators: reasons for existence or lack of public acceptance. – KORA Bericht 3: 25–30.
Hygnstrom, S. E. and Craven, S. R. 1988. Electric fences and commercial repellents for reducing deer damage in cornfields. – Wildl. Soc. Bull. 16: 291–296.
Kaji, K. et al. 2010. Adaptive management of sika deer populations in Hokkaido, Japan: theory and practice. – Popul. Ecol. 52: 373–387.
Kellert, S. R. et al. 1996. Human culture and large carnivore conservation in North America. – Conserv. Biol. 10: 977–990.
Kvaalen, I. 1998. Acceptance of lynx by sheep farmers – a sociological comparison. – Council of Europe Publishing.
Likert, R. 1932. A technique for the measurement of attitudes. – Arch. Psychol. 140: 1–55.
Mbaiwa, J. E. and Stronza, A. L. 2011. Changes in resident attitudes towards tourism development and conservation in the Okavango Delta, Botswana. – J. Environ. Manage. 92: 1950–1959.
McCullough, D. R. 1974. Status of larger mammals in Taiwan. – Tourism Bureau, Taipei, Taiwan.
McCullough, D. R. 2009. Sika deer in Taiwan. – In: McCullough, D. R. et al. (eds), Sika deer: biology and management of native and introduced populations. Springer, pp. 549–560.
McIvor, D. E. and Conover, M. R. 1994. Perceptions of farmers and non-farmers toward management of problem wildlife. – Wildl. Soc. Bull. 22: 212–219.
Mehta, J. N. and Heinen, J. T. 2001. Does community-based conservation shape favorable attitudes among locals? An empirical study from Nepal. – Environ. Manage. 28: 165–177.
National Statistics Taiwan 2010. Agriculture, forestry, fishing, and animal husbandry statistics 2010. – <www.dgbas.gov.tw/public/data/dgbas04/bc1/public/agr3.html> Accessed 6 November 2014.
Naughton-Treves, L. and Treves, A. 2005. Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. – In: Woodroffe, R. et al. (eds), People and wildlife: conflict or coexistence? Cambridge Univ. Press, pp. 252–277.
Osborn, F. V. and Parker, G. E. 2002. Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. – Oryx 37: 80–84.
Pei, K. J. C. 2009. The present status of the reintroduced sika deer in Kenting National Park, southern Taiwan. – In: McCullough, D. et al. (eds), Sika deer: biology and management of native and introduced populations. Springer, pp. 561–570.
Pingtung County Government 2010. Demographical statistics 2010. – < www.pthg.gov.tw/plancab/Index.aspx > Accessed 1 January 2013.
Prokop, P. et al. 2009. Vampires are still alive: Slovakian students' attitudes toward bats. – Anthrozoos 22: 19–30.
Røskaft, E. et al. 2007. Human attitudes towards large carnivores in Norway. – Wildl. Biol. 13: 172–185.
Schumann, B. et al. 2012. Attitudes towards carnivores: the views of emerging commercial farmers in Namibia. – Oryx 46: 604–613.
Sekhar, N. U. 2003. Local people's attitudes towards conservation and wildlife tourism around Sariska Tiger Reserve, India. – J. Environ. Manage. 69: 339–347.
Skogen, K. et al. 2008. Cry wolf!: narratives of wolf recovery in France and Norway. – Rural Sociol. 73: 105–133.
Stem, C. J. et al. 2003. Community participation in ecotourism benefits: the link to conservation practices and perspectives. – Soc. Nat. Resour. 16: 387–413.
Takatsuki, S. 2009. Effects of sika deer on vegetation in Japan: a review. – Biol. Conserv. 142: 1922–1929.
Treves, A. et al. 2009. Participatory planning of interventions to mitigate human–wildlife conflicts. – Conserv. Biol. 23: 1577–1587.
Wang, Y. et al. 2009. Investigation and management plan on Formosan sika deer (*Cervus nippon taiouanus*) at Greater Kenting National Park Area. – Headquarters of Kenting National Park, Pingtung, Taiwan, in Chinese with English abstract.
Wang, Y. et al. 2010. Investigation and management plan on Formosan sika deer (*Cervus nippon taiouanus*) at Greater Kenting National Park Area (II). – Headquarters of Kenting National Park, Pingtung, Taiwan, in Chinese with English abstract.
Weathington, B. L. et al. 2010. Research methods for the behavioral and social Sciences. – Wiley.
West, B. C. and Parkhurst, J. A. 2002. Interactions between deer damage, deer density and stakeholder attitudes in Virginia. – Wildl. Soc. Bull. 30: 139–147.
Williams, C. K. et al. 2002. A quantitative summary of attitudes toward wolves and their reintroduction (1972–2000). – Wildl. Soc. Bull. 30: 575–584.
Yen, S. C. et al. 2012. Population status of Formosan sika deer (*Cervus nippon taiouanus*) in Kenting National Park and nearby area. – J. Natl Park 22: 27–40, in Chinese with English abstract.