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Mitigating Human-Elephant Conflict near Shwe-U-Daung Wildlife Sanctuary, Myanmar

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Abstract. Human-elephant conflict (HEC) in Myanmar poses a serious threat to wild elephant conservation. We initiated a project to build the capacity of local communities for mitigating HEC around Shwe-U-Daung Wildlife Sanctuary. Our goal was to reduce the amount of conflict and to improve communities' ability to cope with elephant damage in a sustainable way. We achieved this by developing and implementing village action plans, improving communications related to HEC both within and among villages, and by enhancing and expanding the types of mitigation techniques used by the villagers.

Introduction

Myanmar is a key country for the conservation of Asian elephants (*Elephas maximus*) with the largest amount of remaining wild land in elephant ranges (Leimgruber *et al.* 2003), and a large elephant population. Population estimates for Myanmar vary from 4000-5300 (Sukumar 2006) to less than 2000 wild elephants (Leimgruber *et al.* 2011). As in other Asian elephant range countries, human-elephant conflict (HEC) in Myanmar poses a serious threat to wild elephant conservation. Community-based, farmer-level methods have been described as the best approach to mitigating HEC because interventions that are driven by government departments or non-governmental organizations are often not sustainable over the long-term given funding situations or their perceived lack of transparency to the communities (Osborn & Parker 2003). Community-based programs, on the other hand, can help increase the community's trust of management (O'Connell-Rodwell *et al.* 2000), which is an important aspect of conservation (Stern 2010), and support HEC mitigation. For example, communities in the Western Ghats of India preferred decentralized and participatory strategies and were willing to contribute labour to elephant conservation (Ninan & Sathyapalan 2005). Few studies have examined human-elephant interactions in Myanmar, and the capacity, training, and resources to help local communities mitigate human-elephant conflicts are extremely limited (Leimgruber *et al.* 2003). Here we describe a community-based project to build the capacity of local communities for mitigating HEC around Shwe-U-Daung Wildlife Sanctuary in Myanmar.

Methods

Study area

Established in 1941, Shwe-U-Daung Wildlife Sanctuary (SWS) (326 km^2) is located in Tha-beik-kyin and Moe-kok Townships in the Mandalay Division, and Moe-meik Township in northern Shan State (Fig. 1). SWS lies within Myanmar's principal agricultural region and people have farmed the area for centuries. In the 1990s, changes in human population and habitat led to increased HEC in SWS and the surrounding area, growing from 1–3 to 8–10 events per year (Aung 2007). Elephants that had primarily lived in SWS began to range outside the sanctuary and their numbers began to decline (Leimgruber *et al.* 2011). The area around SWS lost forest, particularly southwest of the sanctuary, primarily due to rapid human population growth 6.4%/year from 1996 to 2000 and 3.8%/year from 2001 to

2003 (Township State Peace and Development Council Annual Reports 1995-2003). Encouraged by businessmen, people moved into the area from across the Ayeywaddy River in Shwe-bo and Sagaing Districts for illegal gold-mining, charcoal, and bamboo extraction opportunities inside the sanctuary.

In 2008, SWS staff estimated that two groups of elephants, each with 20-30 individuals, lived in and around SWS, down from a total of 90-100 individuals in the early 2000s (pers. comm. warden of SWS). Part of the elephant population decline was due to the capture of elephants by the government's Myanmar Timber Enterprise (MTE) for use in the timber industry. In 2002 local authorities asked the Ministry of Forestry to increase the number of capture permits in the area for MTE and private catchers to help mitigate conflict and 63 elephants were captured from 2002 to 2005. Seven elephants died during capture, which has a high mortality rate in Myanmar (Aung 1997).

We worked with the warden of SWS to identify the primary locations of HEC around the sanctuary in October 2007, and identified 12 villages, to the southwest of SWS (Fig. 1). One village in the area was established more than 200 years ago and two others were established earlier in the 20th century. The other nine villages were established within the last 30 years. Two of the villages were initially established as temporary camps for bamboo extraction and were later registered as villages. Village populations ranged from less than 100 to more than 1000.

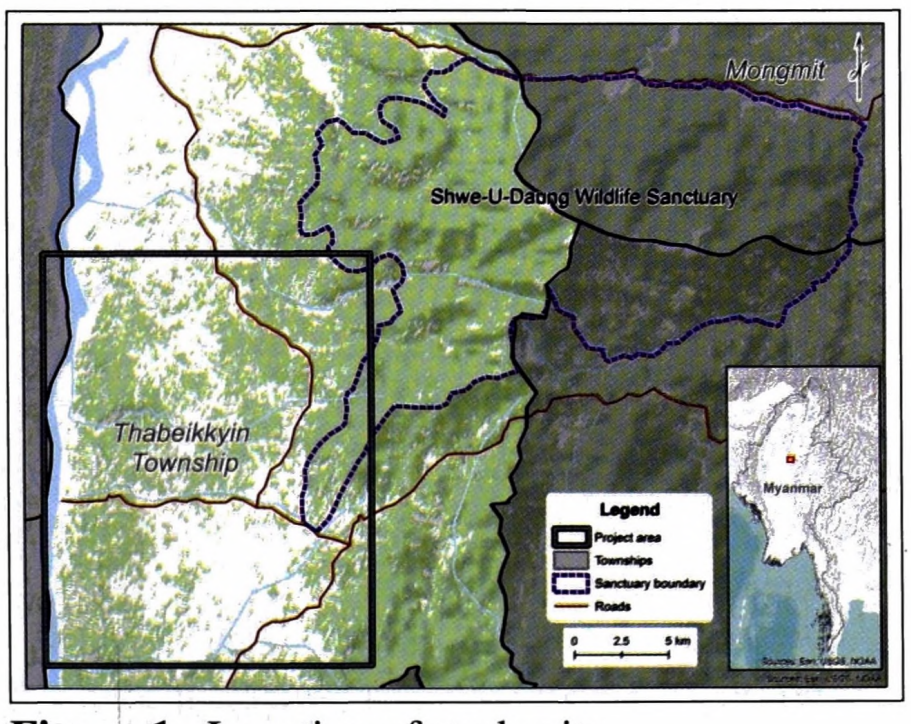

Figure 1. Location of study site.

Data collection and project activities

We conducted demographic and attitudinal surveys, as well as focus discussions in each of the 12 villages to assess people's attitudes toward elephants and to identify and describe HEC events in the area. We compiled historical HEC data through interviews with farmers and from SWS records from 2000 to 2006, and collected data on HEC events that occurred during the survey period. We obtained data on wild elephants from the Forest Department and SWS records. Following the period of information-gathering, a meeting was held with nine village chairmen whom the sanctuary warden and other officials had recommended for participation in the project. Five of these villages volunteered to participate in the HEC mitigation project.

In each of the participating villages, we held meetings to describe the project. Subsequently, 5-8 representatives from each village, with whom we had detailed discussions, helped create volunteer Elephant Protection Committees (EPC) within the context of the traditional formal system of village authority. EPCs consisted of the village chairman and two or more members of the community who were chosen based on their knowledge and close ties to the forest. We conducted a one-day workshop for the first five villages together in early 2008, during which EPC members were trained to maintain sighting records of wild elephants and to record elephant sightings by villagers. Resource mapping activities were conducted with the EPC members to understand which parts of the village and fields were most vulnerable to elephants. Members described the HEC mitigation methods currently used by their village and we shared with them mitigation methods collated from a review of literature.

Following the workshop, the EPCs of each village drafted action plans with the understanding that they would be primarily responsible for overseeing implementation of the activities in collaboration with village residents. Contents of each village's action plan included: 1) identifying priority sites around the village where elephants were most likely to enter from the sanctuary into

the villages and fields; 2) describing a system for people to use loudspeakers to call other villagers when elephants came into the village or croplands; 3) listing specific mitigation activities to be conducted; and 4) choosing which members would keep records for the community, including where elephants were seen. Everyone in the village was informed about reporting sightings of elephants or elephant signs to an EPC member. Two SWS staff was trained as project assistants. They learnt how to lead community meetings and work as facilitators, helped the communities write the action plans, and learned how to monitor HEC and maintain records and how to teach community members these skills. SWS staff made monthly visits to each village to facilitate and monitor implementation of the action plans over the next two years. In May 2008 three public meetings with one to three villages at each meeting were convened to discuss the success of action plans in mitigating elephant damage and to plan future actions. Participants analyzed the information in their record books, compared the results of the methods used to scare away elephants, and shared overall experiences.

At the end of the project in 2010, surveys were conducted in the five project villages with a random sample of community members (n=95) and EPC members (n=32 of 50). The community survey was designed to evaluate people's understanding of the project and their perceptions of its success or failure. The EPC member survey was conducted to measure their opinions about being leaders of the project.

Results

Attitudes toward elephants

The attitude survey conducted at the beginning of the project showed that, despite the conflicts with elephants, the majority of respondents liked elephants and believed they should be protected in Myanmar (Table 1). Two-thirds of respondents said they like elephants because they are valuable, while one-third said that they benefit the country. Two percent said they liked elephants because they are rare wild animals. In response to why elephants should be protected, the majority again said because it is a valuable animal, while a minority felt that they should be protected because their habitat has been encroached, because protecting them in the forest would help to keep them from entering human settlements and agricultural fields, and because they are rare wild animals.

For those who reported disliking the elephant, the main reason was due to crop damage, followed by having their movements inhibited by elephants, i.e. people were "not free" to go into the forest. Other reasons for disliking elephants were that

Table 1. Beliefs and knowledge about elephants (n = number of respondents who answered that question).

Question	%
Do you like elephants? (n=91)	
Like	71
Dislike	24
Do not know	5
Why do you like elephants? (n=78)	
Valuable	66
Benefit the country	32
Rare wild animal	2
Why do you dislike elephants? (n=26)	
Crop damage	24
Inhibit human movement	18
Kill humans	17
Eat paddy	15
Dangerous for humans	14
Destroy houses	12
Should elephants be protected in Myanmar? (n=91)	
Yes	77
No	10
No response	13
Why should they be protected? (n=85)	
Valuable animal	61
If they destroy cropland (i.e. "protected" understood as elephants being contained in the forest)	17
It is their habitat	12
Rare, wild animal	10
Why do elephants come to the villages? (n=77)	
They like to eat crops	66
They are following habitual trails	9
To eat rice, salt, paste stored in the house	6
To eat rare food	6
People moved into elephant habitat	5
Increased human population	4
Forest degradation	2
They move away from being caught by private & MTE	2

they were dangerous to humans and destroyed houses. When asked why elephants entered villages, the majority of respondents said it was because elephants like to eat crops (Table 1). Others suggested that elephants were following their habitual trails.

Conflict mitigation activities

Prior to this study, people were using mitigation methods such as physically guarding the crops, making noise, burning fires, lighting firecrackers, firing home-made firearms, and flashing lights at the elephants on a household basis, with no systematic or collaborative action among farmers. After the creation of the community-based plans for mitigating HEC, the villages used combinations of three different mitigation techniques (Table 2):

Sensory Disturbance

Light, sound, and smell were used in combination in all villages whenever villagers saw elephants entering the village or croplands. Individuals were posted as lookouts in priority sites and alerted villagers by using loudspeakers provided through the project. Each household would be responsible for different mitigation methods, such as lighting fires, shining flashlights, or beating drums. One farmer in Ohn-ta-gu shared two devices he had developed. One device was a small windmill made with plastic blades that would turn in the wind and hit tin cans to create noise and scare away elephants. The other device was a trigger alarm that consisted of a nylon thread strung around a crop field and attached to a stone inside a tin can that would alert the household when disturbed. Le-mile and Du-sit-chaung villages incorporated these methods into their plans. Villages burned rubber, cattle dung, and chillies to create a noxious smell, though this

Figure 2. Stringing CDs to keep elephants out.

was only useful if the wind was blowing toward the elephants. Burning rubber was a method from Thailand introduced by the second author, but during the project villagers stopped using this method because of the negative environmental effects. Villagers also experimented with another idea from Thailand: stringing CDs along the fence to reflect people's flashlights at night (Fig. 2). One village also tied flashlights to bamboo poles that faced the sanctuary. A mixture of chilli, pepper oil, tobacco, and grease was smeared on the string fences because it seemed to repel elephants.

Brush clearing

Villagers cut shrubs, tall grass, and small trees in unused land between the agricultural fields and SWS in a strip about 300-400 m wide. This was a new method conceived by us based on discussions with park staff and a community member who explained that elephants hid in the forest during the day and came to the fields at night. We hypothesized that elephants might hesitate to cross cleared areas and it would be easier to scare them back into the forest at night. During the first year, brush clearing was only used in Le-mile and Thabeikyn. Le-mile cleared every six

Table 2. Types of intervention used in the five villages and changes in HEC conflict in the first year of the project.

Village	Light, sound, and smell	Visual clearing	Unpalatable crops	Type of conflict eliminated	Type of conflict increased
Le-mile	√	√	√	All	None
Ohn-ta-gu	√			Human	None
Ka-be	√	√		Human	Crop and house damage
Du-sit-chaung	√			House, human	None
Kwe-mwe	√		√	House, human	Crop damage

months and Thabeikyn cleared annually. When the other villagers saw the success of the method they all implemented brush clearing during the second year.

Planting unpalatable crops

In Le-mile and Kwe-mwe, some farmers planted unpalatable crops such as sesame, ground nuts, agar wood, sandalwood, and chilli, as well as high-value trees. However, sugar cane was a very profitable crop and most farmers continued to plant sugarcane and were not that interested in alternative crops. Even so, in following years, sugar cane became less profitable and farmers stopped planting it, along with corn, which also had little value.

Additionally, at the warden's suggestion, signboards were posted at places along the main road where elephants were known to cross, to mitigate the problem of cars and motorbikes hitting elephants when they crossed the road.

Project evaluation

As mentioned above, in 2008, SWS staff had estimated that two groups of elephants, each with 20-30 individuals, lived in and around SWS. Both elephant groups roamed to the west and south of SWS in surrounding reserve forest and croplands but only one group periodically entered SWS. We found that conflicts decreased after the villages implemented the mitigation plans (Table 3). In the first year of the project in the five villages, no humans were killed, and three villages avoided any house damage. Le-Mile was the only village to implement all three types of activities and was successful in eliminating all three forms of conflict – human, house, and crop damage. In the second year of the project very little crop damage occurred in Le-Mile and Kyaukkwe. Only one house in Le-Mile and one small hut located beside cropland in Sinmwe village were destroyed by elephants. Most crop damage occurred in private company agricultural land rather than on village farmland. The combination of light, sound, and smell was very effective in driving the elephants away in all villages and brush clearing, particularly at Le-mile where they cleared every six months, was completely effective. After the first clearing, Le-mile had no elephants enter the village or

Table 3. Number of conflicts before (average per year from 2000-2006) and during the first year of the project in the original five villages.

Village	Conflict	Before	During
Le-mile (n=16)	Crop	8	0
	House	5	0
	Human	3	0
Ohn-ta-gu (n=16)	Crop	5	5
	House	1	1
	Human	4	0
Ka-be (n=13)	Crop	0	1
	House	1	4
	Human	2	0
Du-sit-chaung (n=9)	Crop	2	2
	House	2	0
	Human	1	0
Kwe-mwe (n=7)	Crop	1	3
	House	1	0
	Human	2	0

Table 4. Community evaluation survey (n=95) for villages in first phase of project.

Question	%
Are you aware of the program?	
Yes	100
Did you participate in its activities?	
Yes	84
No, but family members participate	12
No	4
Purposes or goal of this program?	
Correct answer	86
Not correct	8
Don't know	6
The name of committee set up in your village?	
Correct answer	76
Not correct	22
Don't know	2
Have you spoken with an EPC member?	
Yes	82
No	18
How many times?	
<5	20
50-10	40
10-20 times	22
Do you feel this program is successful or not?	
It can be in the future	19
Maybe, doing something is better than doing nothing	58
Success is difficult, it depends on long-term good leadership	17
Don't know	6

cropland. Although elephants were spotted coming close, villagers were able to drive them away and no damage occurred.

The evaluation by community members showed that the majority of people understood the goals of the project and also knew the name of the committee that was organizing the activities (Table 4). The majority of respondents reported speaking with committee members multiple times, indicating that the project was successful in including all members of the community and in providing them information about the project. When asked if the project was successful, the answers were tempered with a perspective that the project was in the beginning stages. While the vast majority felt that the project had the potential to be successful, they also pointed out that success depended on the long-term results and good leadership, while others said that doing something was better than nothing.

In the evaluation survey of the EPC members (Table 5), which was conducted with members from the original five villages, nearly all of them said that the project was helping to mitigate the HEC. All said they benefited from being members of the committee in terms of gaining knowledge and participating in their community. They also all felt that the process of creating the actions plans was useful because it gathered everyone's knowledge about the elephants, such as mapping their routes, gave them new ideas of mitigation activities, and helped the community to work together. They reported that they felt combined methods were the most successful, with one-quarter saying that unpalatable crop planting was the best method and one-fifth preferring brush clearing. Two-thirds of the EPC respondents said they supported the capture of elephants by the government and private companies in order to reduce the number of elephants. One-third said they did not support it because it causes the death of some elephants, which is not good for the country or for the people of Myanmar because it is a valuable species, and everyone should work together to conserve them.

Table 5. EPC evaluation survey (n=32) in first phase of project.

Question	%
Do you think that HEC has decreased since the action plans were implemented?	
Yes	96
Don't know	4
Do you enjoy participating in the meetings conducted by this program?	
Yes	100
Do you think the process to make the action plans was useful?	
Yes	100
Which methods do you prefer to protect the crops and households from elephant?	
Combined methods	56
Unpalatable crop planting	24
Visual clearing	20
Do you think the government should allow capturing of the elephants?	
Yes	68
No	32

Discussion

The primary objective of our project was to improve communities' ability to cope with elephant damage in a sustainable, community-based way that was not dependent on external resources. An underlying assumption of the project was that while the eradication of conflicts is not likely, reduction can be achieved (O'Connell-Rodwell *et al.* 2000; Osborn & Parker 2003). Like Graham and Ochieng (2008), our goal was to "demonstrate and evaluate community-based tools for HEC management, with the consent and participation of local community groups." This goal was accomplished by creating and implementing HEC action plans for each participating village, improving communications related to HEC both within and among villages, enhancing and expanding the types of mitigation techniques used by the villagers, and evaluating people's attitudes and perceptions of the changes in HEC events and HEC management to inform HEC planning in the future. Through this project, communities shared with each other the methods that they were already using to mitigate elephant damage, and new ones were also introduced, e.g. alert systems and brush clearing. Based on discussions of these methods within and among communities, communities wrote action plans for mitigating the HEC for the first time.

The project was successful in that there were fewer conflicts after the project began than before and there were no human injuries or deaths in any of the participating villages in the first year of the project. In Le-Mile, where brush clearing was used in addition to other mitigation activities, the project was most successful. Elephants are wary of crossing an open area to get to agricultural fields and the open area allowed farmers to easily see elephants, giving them time to mount an active defence. Other studies have also shown that wide buffers of vegetation not suitable for food or cover can decrease elephant movement in an area (for example, Nyhus & Tilson 2004). However, caution must be used when comparing the number of conflicts before and after the project. Before the project started, conflicts were self-reported by villages to park staff and not verified in any systematic manner. Another confounding factor is that ten elephants were captured by the MTE just as our project was beginning, and this may have significantly changed the elephants' behaviour. The villagers believe that this activity caused the elephant groups to splinter, resulting in elephants visiting the village singly or as mother-offspring groups instead of in groups of 7 or 8 as previously seen. This change in behaviour contributed to villagers being wary of pronouncing the project a success but thought it might be in the future.

Another indicator of the project's success is that four additional villages asked to join the project at the end of the first year. To address their request, we conducted a workshop for these additional four villages in the second year of the project, with participation from EPC members and government officials from SWS and the Forestry and Agricultural Departments.

Two key factors underlying the success of the project were that people were supportive of elephant conservation and we spent a great deal of time engaging with communities and relevant government officials before initiating the project. The support we found for elephant conservation in this project is not unusual. Just as the majority of people in this project site supported elephant conservation, the majority of respondents facing HEC in Sri Lanka, India, and Uganda, also valued elephants and supported their conservation (Hill 1998; Bandara & Tisdell 2003; Barua *et al.* 2010). The time spent conducting research prior to actively engaging the communities in mitigation activities gave insight into HEC challenges the communities faced and helped develop relationships with community members. The investment in understanding the communities' history, socio-economic status, resource use, and attitudes toward the sanctuary and the elephants was critical to developing constructive working relationships with the communities and the sanctuary staff.

One interesting limitation of the project was the uneven participation of women. Based on the success we had encouraging women's participation into other projects in Myanmar (Allendorf *et al.* 2012), we encouraged communities to include women on the EPCs. However, we found it was difficult for women to participate because of traditional beliefs about elephants. People believed that elephants are jealous of women because of their shorter gestation period, causing them to attack humans if women are nearby. One of the outcomes of this is that women were not members of EPCs although they did participate in the community workshops and meetings and in implementing the action plans.

In conclusion, by focusing on village resources and knowledge, supplemented with experiences from other countries, we built on the strengths and capacity that already existed in the communities, and helped residents find community-based solutions that are more sustainable over the long-term. However, while grassroots support and commitment from communities is vital to successful mitigation of HEC, community-based conservation may not succeed over the long-term without top-down support from government and its policies. Community-level mitigation, particularly in the case of wildlife conflict over large landscapes, should be considered in the context of national-level planning and sharing of information (Fernando *et al.* 2008). A broad-scale approach can take into account corridors and seasonal movements, while maximizing benefits from large-scale interventions, such as electric

fencing, corridor restoration, and planting of unpalatable crops. A landscape approach could also incorporate outreach to communities to help them understand the larger context of the contribution they are making to conservation.

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