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RESEARCH ARTICLE

Effect of human–elephant conflict on local attitudes toward the conservation of wild Asian elephants in Myanmar

Zaw Min Thant [a], Roel May [b], and Eivin Røskaft [a]

aDepartment of Biology, Norwegian University of Science and Technology, Trondheim, Norway; bNorwegian Institute for Nature Research, Trondheim, Norway

ABSTRACT

The study of attitudes toward wild elephants and human–elephant conflict (HEC) is vital to understanding what attitudes are held by local people and how to incorporate them into wild elephant conservation. This study investigated the interlinkages between the HEC experience and local people's attitudes toward the conservation of wild elephants and which exploratory factors influence these attitudes. We used a Bayesian Belief Network (BBN) framework to highlight the interlinkages between HEC and people's attitudes. The basic BBN model indicated that HEC was central in determining the attitudes of local people. Although people generally hold positive attitudes toward elephants, people support having elephants in the country but not in their own regions. Conservation willingness was not obvious due to the lack of deliberate assistance from the government to the affected communities. We suggest implementing education programs to promote local awareness of conflict mitigation techniques.

Introduction

The participation of local communities in conservation interventions has been widely accepted for the sustainable conservation of wildlife and protected areas (Bajracharya et al., 2007; Paudyal et al., 2018). Therefore, attitudinal studies of local people about their relationship to wildlife conservation are important to evaluate how local people understand, accept, and respond to the impacts of conservation (Kideghesho et al., 2007; Røskaft et al., 2007). Understanding local people's attitudes toward having wildlife in their vicinity contributes to formulating effective conservation policies, management practices, and public communication strategies (Decker et al., 2001). Eagly and Chaiken (1993) define attitude as "*a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor.*" Other scholars also define attitude as a disposition to express favored or unfavored responses to a given object (Ajzen & Cote, 2008; Decker et al., 2001; Oskamp & Schultz, 2005). Attitudes comprise feelings, beliefs, and behaviors (Oskamp & Schultz, 2005; Pickens, 2005). People tend to behave favorably when they hold positive attitudes toward attitude objects (e.g., wildlife, protected areas), whereas they are likely to respond unfavorably if they have negative attitudes toward these objects (McCleery et al., 2006). Fear of wildlife (Liu et al., 2011; Røskaft et al., 2003; Sarker &

Røskaft, 2010), unpleasant past experiences with wildlife (Abdullah et al., 2019; Hariohay & Røskaft, 2015; Liu et al., 2011; Nsonsi et al., 2017; Sarker & Røskaft, 2014), and lack of help from the government (Abdullah et al., 2019; Naughton-Treves, 1997) shape the negative attitudes of local people toward wildlife conservation. Negative attitudes of local people toward wildlife hamper public support for the implementation of conservation measures (Røskaft et al., 2007).

The total population of wild Asian elephants (*Elephas maximus*) has been declining in most countries (Williams et al., 2020). Human–elephant conflict (HEC) accounts for a prominent threat to the sustainable conservation of wild elephants (Røskaft et al., 2014; Sukumar, 2003; Williams et al., 2020). Dublin and Hoare (2004) define HEC as a direct interaction resulting in negative impacts on both humans and elephants, such as damage to property or crops, injuries, and fatalities of humans and their livestock, or human retaliation against elephants. Anthropogenic activities, such as human settlement and cultivation in elephant-occupied forests and the collection of forest products, harm elephant habitats. Habitat fragmentation, degradation and loss, and poaching are believed to reinforce HEC and the population decline of wild elephants as well. Decker et al. (2001) stated that the threshold of people's acceptance of wildlife is condition-specific and relies on the severity of the human-wildlife conflict. The experiences of HEC can reduce the tolerance of local people for wild elephants and influence their attitudes (Abdullah et al., 2019; Sarker & Røskaft, 2014; Talukdar & Choudhury, 2020). The interactions between wild elephants and humans have intensified in Myanmar (Sampson et al., 2019; Thant et al., 2021). Although many studies on the human dimension of elephants have been found in Africa and Asia (see references above), this type of research is limited in Myanmar. This indicates the necessity of understanding how local people perceive HEC and what factors determine or interlink attitudes toward wild elephants and conservation in Asia in general and Myanmar in particular.

This study aims to explore the interlinkages between the HEC experience and attitudes of local people toward HEC management and wild elephant conservation in elephant habitats in Myanmar and to examine the characteristics of the respondents that were most influential on their attitudes. As attitudes related to aspects may be connected (e.g., a negative HEC experience may affect the attitude toward conservation), a Bayesian Belief Network (BBN) approach was used to explore our research objective.

Methods

Study Area

The study was conducted in four different regions in Myanmar: three HEC regions that have experienced HEC over the last decades and one control region without HEC (Figure 1). The HEC regions consisted of (1) the community around the Rakhine Yoma Elephant Range (Rakhine) in southern Rakhine State (two townships) and the northwestern Ayeyawady Region (three townships); (2) two townships in the Yangon Region (Yangon); and (3) three townships in the Ayeyawady Region (Ayeyawady). Four townships situated further away from elephant habitats were selected as the

control region to compare attitudes with the HEC-affected communities (Figure 1; see, Thant et al. (2021) for further descriptions of the study areas).

Data Collection

A structured questionnaire was applied with face-to-face interviews, and a few open-ended questions were included to allow for further explanations. Simple random sampling techniques were used in the survey. The study was conducted in 10 villages each within the three HEC regions (a total of 30 villages) and 10 villages in the control region, for a total of 399 respondents in 40 villages. A linear cross-sectional study was employed for the selection of villages in the control region to fairly represent the results of the survey. Before the survey, we informed the village leaders by explaining the objectives and methods of our research and sought their consensus. In every village, we randomly selected households where one respondent from each household, who was above 18 years old, was interviewed. Before the interview, we explained the aims of the survey to each respondent and then asked for permission to include the respondent in our survey. Then, we proceeded with our interview when the respondent agreed to take part in the study. Answers were recorded anonymously. Interviewing people to investigate their attitudes requires an undisturbed environment. We tried to obtain a private environment to obtain reliable and minimally biased attitudinal answers. For example, in some villages, local people gathered and were interested in listening to the interview. We requested that they disperse before we started the interview
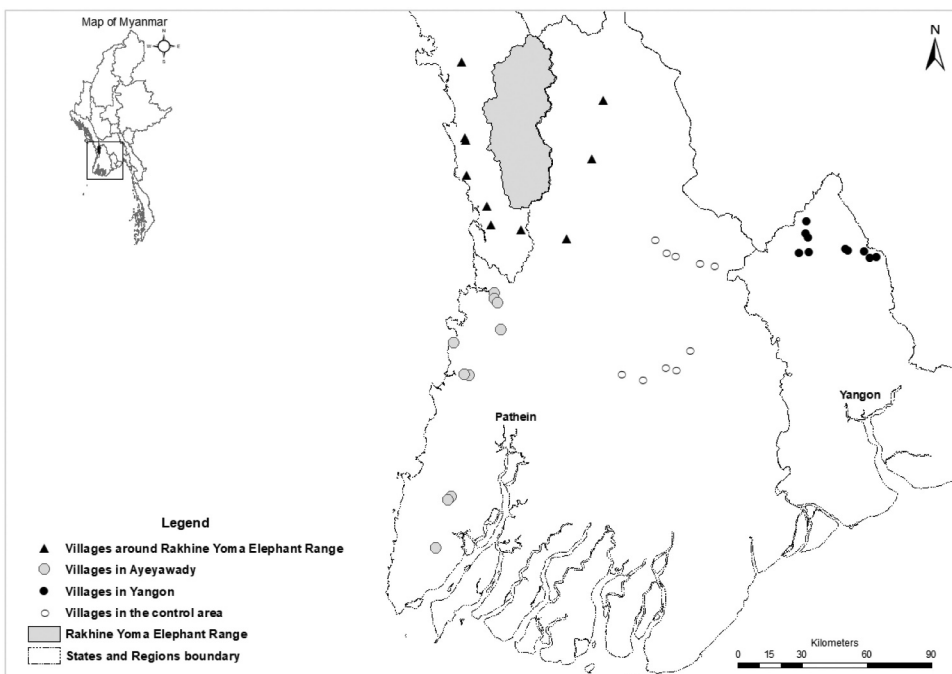

Figure 1. Study area map showing the four different study regions in Myanmar within which attitudes of local inhabitants regarding human–elephant conflict, were surveyed.

process. If the situation was not favored because of too much disturbance, we acknowledged their participation and moved to the next household.

After acquiring the sociodemographic background information of the respondents, we explored the respondents' experiences with HEC (Thant et al., 2021). Subsequently, questions related to HEC, attitudes, and perceptions of wild elephants were addressed as described in Table 2. More general and specific attitudinal questions were asked toward the end of the interview. The four attitudinal questions were intended to illustrate the strength of the respondents' attitudes toward wild elephants. Manfredo and Bright (2008) stated that stronger attitudes are stable and will lead to stronger conservation behavior. Finally, we asked a question to test the respondents' deep concerns about wild elephants.

Bayesian Belief Networks

BBN models provide an integrated modeling framework to structure specific scientific problems and explore various scenarios (Landuyt et al., 2013; McCann et al., 2006; Smith et al., 2018). BBNs are particularly well suited to exploring social-ecological systems characterized by interdependencies between system components (Chen & Pollino, 2012; Jellinek et al., 2014). BBN models represent systems graphically as probabilistic influence networks constituting a network, with all cause-effect relationships made explicit. BBN models can be parameterized using a variety of information, including stakeholder attitudes (or beliefs) (Bakshan et al., 2017; Davis et al., 2020). BBN models assume that the system under study can be described through a directed acyclic graph (i.e., that there are no feedback loops), where each variable is conditionally independent of its nondescendants given its parent variables (i.e., local Markov property). We used this approach to structure causal attitudinal determinants toward HEC. The variables interlinked with each other in the BBN are called nodes. A node being influenced by another node is called a parent node, while a node that is affected by another node is known as a child node. All directed links between nodes are called arcs or edges (Nielsen & Jensen, 2007). All statistical analyses were performed in R Studio version (1.3.959; R Core Team, 2020). Nine variables (gender, age group, education, occupation, ethnicity, religion, residency, size of household, and distance to the forest reserve boundary) were treated as potential explanatory variables, and attitude variables were treated as the response variables. The incidents of crop damage, property damage, and elephant attacks were pooled as HEC experiences (Yes/No) (Thant et al., 2021). Bayes factors were computed by using the BayesFactor package (version 0.9.12–4.2) with a joint multinomial sampling type (Navarro, 2013). Raftery (1995) stated that there was weak evidence of an association between variables when the Bayes factor was between 1–3; whereas 3–20 was positive, between 20 and 150 was strong, and more than 150 indicated a very strong association of events.

Modeling Approach

Using the respondents' attitudes as learning data, a naïve BBN (null model) was constructed using the hill-climbing algorithm. The network structure was constructed using the hc function of the bnlearn package (Scutari & Denis, 2014). Thereafter, all explanatory factors were added to this null model to investigate how these potentially affected the respondents' attitudes (full model). To do this, the hc algorithm was constrained by including all interlinkages (i.e., edges or arcs) of the null model using the whitelist function. In addition, the full model was

constrained to allow only explanatory factors to provide input (i.e., parents) to the null model nodes, using the blacklist function. The parameters of the Bayesian networks conditional on their structure were estimated from the learning data using the bn.fit function. The strengths of the relationships were estimated using the arc.strength function. The BIC score for each node's contribution to the models' goodness-of-fit was estimated using the score function. The BIC score was computed in the bnlearn package as logLik (x) – k * nparams (x). This indicates that the classic definition was rescaled by −2; accordingly, higher BIC scores are better for the model's goodness-of-fit (Nielsen & Jensen, 2007; Scutari & Denis, 2014; Xu et al., 2018). Additionally, an independence test was performed to check which explanatory factors significantly shared mutual information with the null model's variables. The explanatory factors that shared the most mutual information with the null model's variables were added to the null model, which was then labeled the extended model.

Results

Characteristics of Respondents

Most characteristics of the respondents differed statistically between the four study regions (Table 1). In all three HEC regions, most respondents had experienced HEC (loss of crop and property or elephant attack); however, there was strong statistical evidence for the non independence of HEC experience and region (Bayes factor = 5.4e+38; Ayeyawady (78%, N = 79), Yangon (72%, N = 72), Rakhine (50%, N = 49)). None in the control region had experienced any HEC (N = 100).

Structure of the Bayesian Model

Bayesian analyses showed that the HEC experience ("Overall_HEC") was a central node among response variables (nodes) in the BBN null model. HEC experience directly influenced and linked to six nodes: "Elephant_tourism" (BIC score = −3.184), "Live_near" (BIC score = −7.357), "Personal_feeling" (BIC score = −9.269), "Elephant_disappear" (BIC score = −21.136), "Elephant_behavior" (BIC score = −81.785), and "Who_help" (BIC score = −98.994) (see, Table 2 for the description of these variables). Likewise, the "Elephant_disappear" node influenced "Move_to_other country" (BIC score = −13.291), and "Live_near" affected the "Live_in_Myanmar" node (BIC score = −41.183; Figure 2). HEC experience itself was influenced by "How_handle" (BIC score = −25.642), which in turn was influenced by "Who_responsible" (BIC score = −26.375). The "Overall_HEC" node contributed most to the null model's goodness-of-fit (BIC score = −253.917), followed by "Who_help" (BIC score = −351.075) and "Live_in_Myanmar" (BIC score = −405.903).

After all the explanatory factors were added to the null model, distance to the forest reserve boundary ("Dist_to_for") was central among nodes of the characteristics of the respondents in the full model. Religion contributed most to the full model's goodness-of-fit (BIC score = −82.576). However, the null model's BIC score (−6056.482) indicated that it fit better than the full model (BIC score = −8861.896). The independence test between individual attitude nodes and explanatory factors showed that "Dist_to_for," "Residency," "Ethnicity," and "Gender" were dependent on and shared much mutual information with

Table 1. Characteristics of respondents (explanatory factors) in the study area.

Variable	Attribute	Rakhine (n = 98) %	Yangon (n = 100) %	Ayeyawady (n = 101) %	No HEC (n = 100) %	Bayes factor
Gender	Man	75	56	79	61	38.865
	Woman	26	44	21	39	
Age group	18–35 years	17	17	16	17	0.000
	36–59 years	62	62	61	61	
	60 years & above	20	21	23	22	
Education	No formal education	24	21	26	4	2901813
	Primary	45	55	52	37	
	Secondary & above	32	24	23	59	
Occupation	Non-farmer	21	46	25	37	58.906
	Farmer	79	54	75	63	
Ethnicity	Burma	35	82	80	50	3.924e+44
	Rakhine	46	0	2	1	
	Kayin	0	18	18	48	
	Others	19	0	0	1	
Religion	Buddhism	93	88	95	91	0.012
	Christian	7	12	5	9	
Residency	Non-native	52	82	70	29	6.164e+12
	Native	48	18	30	71	
Size of household	Small (1–3)	31	38	37	20	0.023
	Medium (4–6)	63	53	55	72	
	Large (7–10)	6	9	9	8	
Distance to forest reserve boundary	<1 km	80	70	40	0	1.174e+109
	1–4 km	0	30	10	0	
	4–10 km	20	0	50	0	
	>10 km	0	0	0	100	

Table 2. The list of questions that were asked to the respondents in the study on attitudes toward human–elephant conflict in Myanmar.

| Questions	Node
Who helped you/villagers when you/villagers suffered HEC? (a) don't know (b) I received no help (c) forest department (d) others	Who_help
Who should be the responsible organization to take care of HEC? (a) don't know (b) forest department (c) elephant conservation group (d) others	Who_responsible
How should the responsible organization handle problem elephants? (a) don't know (b) scare and drive the elephants away (c) seize and tame them (d) translocate them (e) others	How_handle
Do you agree that interactions between humans and elephants are more intense today because the poaching pressure on wild elephant has increased? (a) strongly agree (b) agree (c) don't know (d) disagree (e) strongly disagree	Poaching
What is your personal feeling of wild elephants? (a) hate (b) fear (c) indifferent (d) love (e) favor	Personal_feeling
What was the behavior of the wild elephants when you encountered them? (a) don't know (b) no problem at all (c) calm (d) aggressive	Elephant_behavior
Would you like to support elephant conservation if tourism activities to watch wild elephants in your locality, will be implemented? (a) strongly support (b) support (c) neutral (d) not support (e) strongly not support	Elephant_tourism
Do you agree that wild elephants have the right to live in your area? (a) strongly agree (b) agree (c) don't know (d) disagree (e) strongly disagree	Live_near
Do you agree that wild elephants have the right to live in Myanmar? (a) strongly agree (b) agree (c) don't know (d) disagree (e) strongly disagree	Live_in_Myanmar
Do you agree with the following statement: Only a dead elephant is a good elephant? (a) strongly agree (b) agree (c) don't know (d) disagree (e) strongly disagree	Dead_good
Do you agree with the following statement: Elephants should be moved to rich countries? (a) strongly agree (b) agree (c) don't know (d) disagree (e) strongly disagree	Move_to_othercountry
If the elephants disappear from your area, what will happen? (a) don't know (b) better for livelihood (c) better for farming (d) good and bad (e) do not want elephants to be extinct	Elephant_disappear
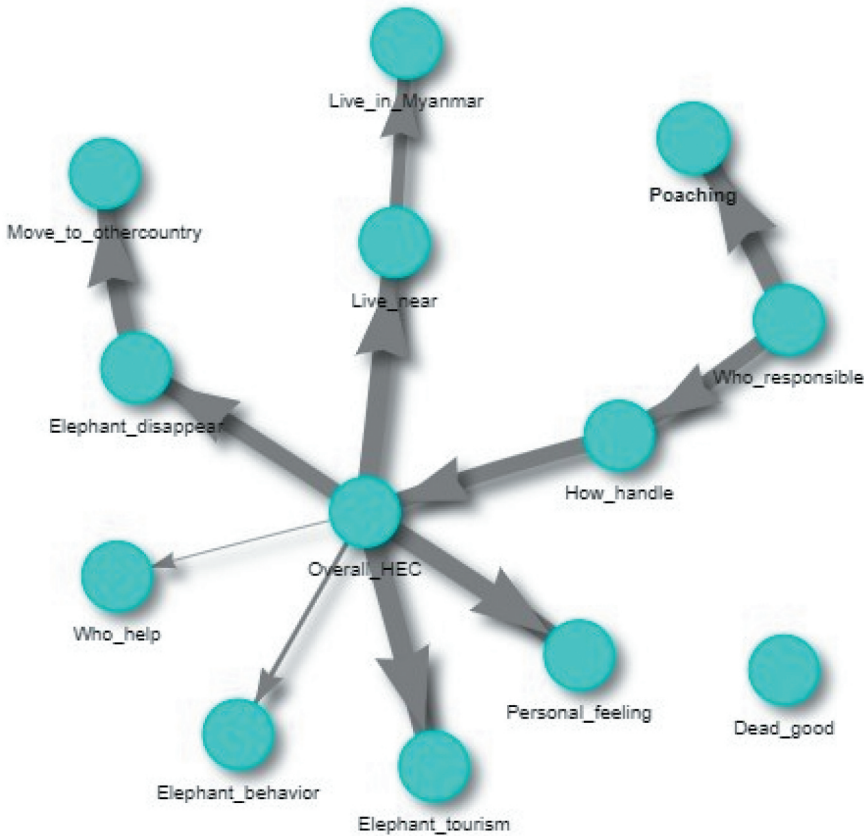
Figure 2. Causal relationship of response variables (nodes in turquoise) in the null model's Bayesian Belief Network representing attitudes toward human–elephant conflict in Myanmar. Arc widths indicate the strength of the linkages in-between nodes.

the attitude nodes (Table 3). These explanatory variables were added to the null model and used to construct the extended model. The "How_handle" node was the most influential on the "Overall_HEC" node (BIC score = 39.197). In turn, the "Overall_HEC" node influenced "Who_help" (BIC score = 12.697) and "Elephant_behavior" (BIC score = 10.231). In addition, the "Overall_HEC" node contributed most to the extended model's goodness-of-fit (BIC score = −235.420), followed by "Residency" (BIC score = −247.299) and "Gender" (BIC score = −254.100). However, the BIC score for the extended model (−7386.251) indicated that the null model was still the better model.

Causal Relationship between Nodes

The "Overall_HEC" and "Dist_to_for" nodes influenced the "Who_help" node, indicating that the HEC experience was a stronger parent node (BIC score = −235.420) than the distance to the forest node (BIC score = −507.247; Figure 3). Most respondents in the HEC regions claimed they had not received any help when they encountered HEC (Figure 4a).

Table 3. Chi-square statistics derived from Independence tests computing the shared mutual information between the explanatory factors (columns) and attitude variables (rows) regarding HEC in Myanmar. The pair of nodes which were significant at $p < .05$ (**in bold**) indicated dependence on each other.

|	Distance to forest reserve boundary	Ethnicity	Education	Residency	Gender	Size of household	Age group	Occupation	Religion
Overall_HEC	**184.638**	**21.063**	**14.002**	**16.984**	2.036	2.588	0.325	**16.126**	0.039
Who_help	**336.714**	**65.964**	**35.632**	**41.152**	5.464	**20.736**	1.171	3.295	**8.137**
Who_responsible	**51.887**	**34.379**	5.062	**11.098**	**9.836**	3.625	9.569	0.242	2.446
How_handle	**114.852**	**21.325**	**22.577**	**16.371**	5.304	5.849	5.006	4.018	1.584
Poaching	**80.262**	16.082	9.778	7.069	**11.641**	5.936	7.302	7.374	3.084
Personal_feeling	**50.280**	**39.869**	**15.019**	**14.734**	**20.615**	**20.423**	11.846	4.850	7.427
Elephant_behavior	**277.193**	**36.838**	**37.333**	**65.251**	6.392	**17.454**	1.289	**8.229**	6.712
Elephant_tourism	**72.961**	**36.850**	12.904	7.903	**17.411**	**16.622**	4.475	7.237	4.318
Live_near	**87.611**	**26.925**	13.813	4.394	**14.585**	7.774	8.230	**9.912**	0.508
Live_in_Myanmar	**71.614**	**44.484**	7.231	**14.916**	7.735	4.398	8.571	7.779	5.629
Dead_good	**34.382**	**38.560**	4.355	5.075	**19.362**	8.488	11.334	1.694	**11.076**
Move_to_othercountry	**55.804**	16.321	**56.475**	3.870	**12.849**	5.229	6.250	3.549	8.884
Elephant_disappear	**112.018**	**26.754**	**48.564**	**24.216**	**14.450**	8.443	13.155	5.612	1.604
Average X^2	**117.709**	32.724	21.750	17.926	11.360	9.813	6.809	6.147	4.727
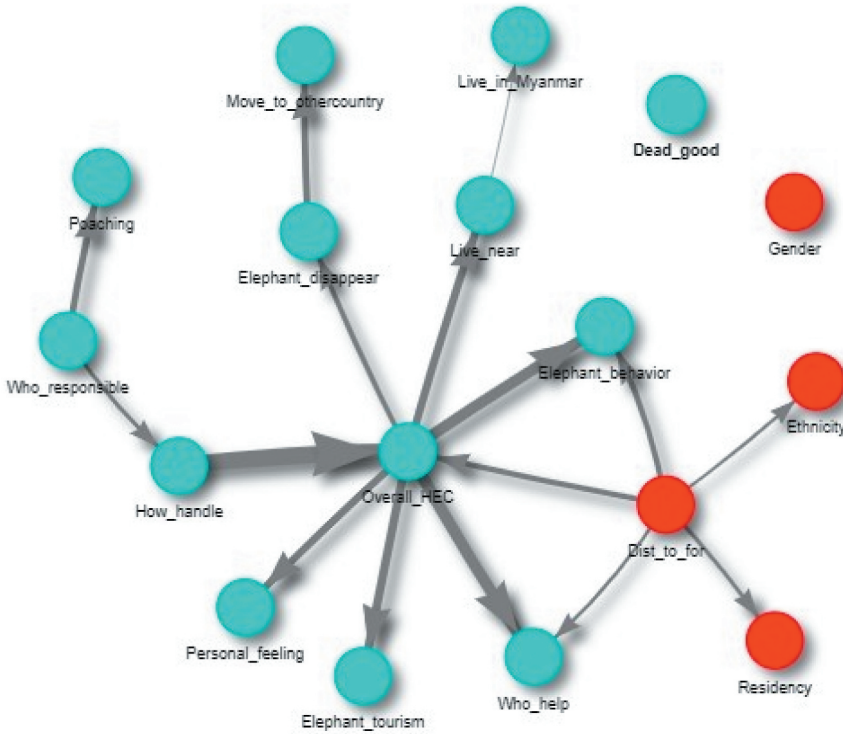
Figure 3. A graphical representation of the extended model's Bayesian Belief Network representing attitudes toward human–elephant conflict in Myanmar after combination with the explanatory variables (in red) that shared most mutual information with the null model's nodes (including only attitudes, in turquoise). The thicknesses of arc widths indicate the strength of the linkages in-between nodes.
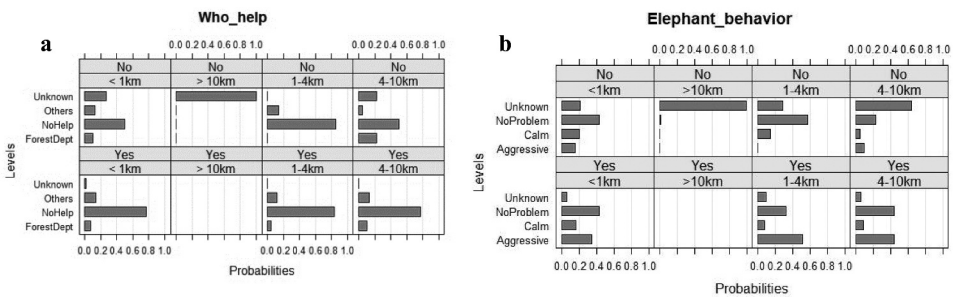

Figure 4. Conditional probability distributions of a Bayesian Belief Network representing attitudes toward human–elephant conflict in Myanmar for (a) Who_help conditional on HEC experience (No/Yes) and distance to the forest (<1 km/1–4 km/4–6 km/>10 km); and (b) Elephant_behavior conditional on HEC experience and distance to the forest.

Likewise, nodes of "Overall_HEC" and "Dist_to_for" were linked as parent nodes to the "Elephant_behavior" node; therefore, HEC experience was the strongest node. The attitude of people toward elephant behavior differed between different distances from the forest

reserves. Those who lived between 1 and 4 km from the forest most likely held the attitude that elephants were too aggressive (conditional probability = 0.51; Figure 4b).

Most respondents expressed fear of wild elephants. Those who had experienced HEC had the highest probability of fear toward wild elephants (conditional probability = 0.63; Figure 5a) compared to those who had never experienced HEC (conditional probability = 0.40; Figure 5a). More people who had never experienced HEC were inclined to have favorable feelings (love and favor) toward elephants compared to those who had experienced HEC. However, even within the group of people who had experienced HEC, they expressed more favor toward elephants than hate. In total, 76% of the respondents (strongly) supported the idea of tourism-related elephant conservation in their area. Respondents who had experienced HEC (conditional probability = 0.71) were, however, less likely to support this type of tourism than those who had no HEC experience (conditional probability = 0.80; Figure 5b).

In total, 64% of the respondents were positive about having wild elephants in their area, whereas 33% were negative and 4% did not have an opinion. The respondents who had no HEC experience were more likely to agree with the statement that elephants should be present in the area (conditional probability = 0.58; Figure 5c) than those who had experienced HEC (conditional probability = 0.36; Figure 5c). Local elephant presence in their area also strongly influenced the opinion that "*wild elephants have the right to live in Myanmar*" (BIC score = −41.183). Interestingly, 87% responded positively to the question of whether elephants should live in Myanmar, whereas 7% were negative and 6% had no solid answer. Although respondents had different attitudes toward having elephants nearby, they all had
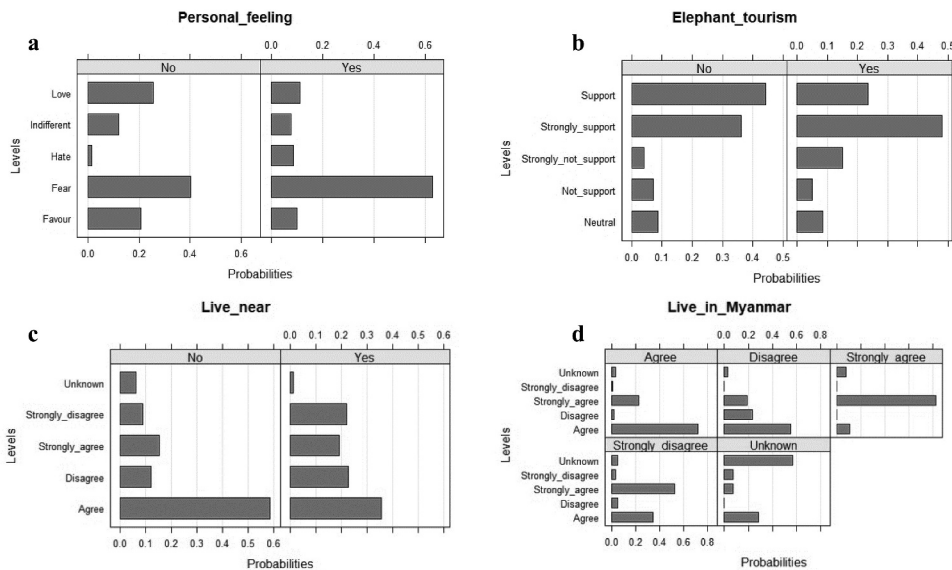

Figure 5. Conditional probability distributions of a Bayesian Belief Network representing attitudes toward human–elephant conflict in Myanmar between (a) Personal_feeling conditional on Overall_HEC (No/Yes); (b) Elephant_tourism conditional on HEC_experience (No/Yes); (c) Live_near conditional on Overall_HEC (No/Yes); and (d) Live_in_Myanmar conditional on Live_near (Strongly agree/Agree/Disagree/Strongly disagree/Unknown).
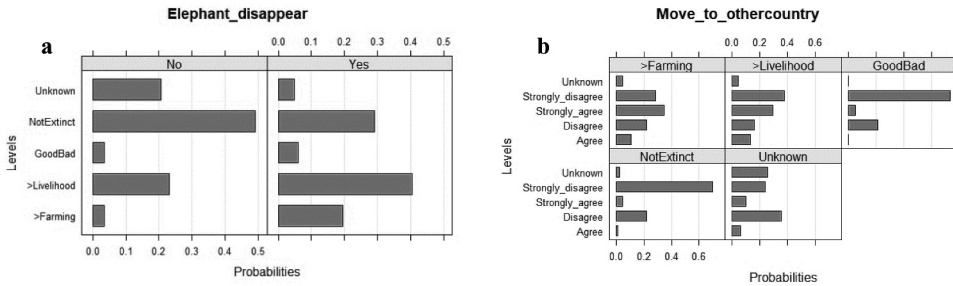
Figure 6. Conditional probability distributions of a Bayesian Belief Network representing attitudes toward human–elephant conflict in Myanmar for (a) Elephant_disappear conditional on Overall_HEC (No/Yes); and (b) Move_to_othercountry conditional on Elephant_disappear (>Farming/>Livelihood/GoodBad/ NotExtinct /Unknown).

a positive attitude toward having them in the country. Those who disagreed/strongly disagreed with the statement of elephant presence in their area were likely to agree/strongly agree to have elephants in the country (Figure 5d).

HEC experience also strongly influenced the willingness for future conservation of wild elephants. Those who had encountered HEC (conditional probability = 0.41; Figure 6a) agreed with the statement that it would be "*better for their livelihood if the elephants disappear from their area,*" while others who had no HEC experience (conditional probability = 0.49; Figure 6a) expressed that "*they do not want elephants to be extinct.*" This node of conservation willingness also influenced the node that "*elephants should be moved to rich countries.*" The respondents who held a two-sided attitude (good and bad of having wild elephants) and the attitude that "*they do not want elephants to be extinct*" (conditional probability = 0.74 and 0.70, respectively; Figure 6b) strongly disagreed with the statement "*elephants should be moved to rich countries.*" The respondents who supported an attitude that it is "*better for farming if the elephants disappear from their area*" strongly agreed with "*move wild elephants to rich countries*" (conditional probability = 0.35; Figure 6b).

Discussion

The BNN is a graphical representation of interlinkages among nodes. In the BBN, HEC experience directly or indirectly influenced the attitudes of local people. Many studies have discussed local communities' experiences of HEC and how these experiences have shaped local attitudes toward wild elephants and their conservation (Abdullah et al., 2019; Granados & Weladji, 2012; He et al., 2011; Jasmine et al., 2015; Nsonsi et al., 2018; Sampson et al., 2019; Sarker & Røskaft, 2014; Talukdar & Choudhury, 2020).

We found that local communities received limited support from the management organization for addressing and mitigating HEC. Respondents mentioned that driving problem elephants back into the forests was the sole and major type of help from management. The responsible management organization did not have a dedicated program to compensate for the losses incurred by wild elephants. A few HEC cases that have occurred in recent years around the Rakhine Yoma elephant sanctuary resulted in some amount of compensation through the Township General Administration Department (Park Warden, personal communication), but no other form of compensation was provided in the other

two HEC landscapes and other regions in Myanmar. Local communities chased wild elephants off by shouting, using firecrackers, or beating sound-making objects. The Forest Department collaborated with the Myanma Timber Enterprise (MTE) in the study areas to drive wild elephants back. However, local people complained about late responses by the organization as the wild elephants moved away before they arrived. The organization used trained captive elephants or "*koonkies*" from MTE to chase problem elephants. The task of elephant-driving back to the forest is frequently delayed due to the long travel distance by *koonkies* to the affected villages or sites (Zaw Min Naing, personal communication). Fernando et al. (2008) stated that although the use of *koonkies* to chase problem elephants seems an appropriate practice, the longer travel time and distance by *koonkies* would be less efficient. This practice is not an ultimate solution to address HEC, as wild elephants return after being driven into the nearest forests (Baskaran et al., 2006).

Living close to wild elephants has extensive costs (Hariohay et al., 2019; Sarker & Røskaft, 2014; Talukdar & Choudhury, 2020), and this negatively impacts people's attitudes. We found that people who experienced HEC and lived between 1 and 4 km from the forest reserves expressed more aggressive behavior of wild elephants than people living in other places, as they suffered the most elephant attacks on their property (Thant et al., 2021). Those who lived farther away (>10 km) from elephant habitats never suffered any cost related to HEC and elephant conservation. Other studies have stated that people who live farther away from protected areas have more positive attitudes toward wildlife conservation (Hariohay et al., 2018; Hariohay & Røskaft, 2015; Sarker & Røskaft, 2010). In our study, more people showed a higher preference to live with elephants in the country than in their region. Some local people expected that it would be better if wild elephants were protected in a specific area, such as a sanctuary. Fear and concerns about potential elephant attacks likely discourage coexistence with elephants. Sampson et al. (2019) demonstrated that the majority of the respondents agreed that elephants should live farther away from their settlements.

Our results reveal that most respondents tended to have positive attitudes toward wild elephants despite half of all respondents having HEC experience. However, other studies have shown that conflicts with wild elephants correlate relatively with negative attitudes toward conservation (Abdullah et al., 2019; Hariohay & Røskaft, 2015; Nsonsi et al., 2017; Røskaft et al., 2014; Talukdar & Choudhury, 2020). Similar studies of HEC in Myanmar showed that local communities support elephant conservation even when they had experienced HEC (Allendorf et al., 2015; Sampson, 2018). More than 90% of the respondents in this study were Buddhists. The elephant is regarded as a sacred animal in Buddhism (Ramanathapillai, 2009). The elephant plays a significant role in the social, cultural, and religious dimensions of Myanma society, and it is still used in religious and ceremonial events (Henning, 2002). Additionally, the respondents acknowledged the utilitarian role of elephants in the timber extraction industry. These factors explain the general acceptance and tolerance toward wild elephants. Some respondents stated that they felt hatred toward wild elephants when elephants attacked crops. However, this negative feeling gradually disappeared, and they then pitied them because elephants raided the crop due to the scarcity of food. BBN analyses indicate that people who were never affected by HEC were more favorable to elephants, were more supportive of elephant tourism, and were more positive about having elephants in their region. People who were exposed to HEC were more concerned about elephant attacks on their crops, property, and family members if elephants

lived nearby. In addition, some people who experienced HEC opposed elephant tourism because they feared that the increased population of wild elephants may result in increased damage and attacks. This finding indicates that the limited or absent deliberate government assistance or mitigation measures for HEC has caused negative attitudes within HEC-affected communities toward elephant conservation. Borah et al. (2021) stated that people who had experienced HEC develop negative attitudes due to delayed compensation or lack of effective assistance from the government.

Education was also one of the most influential factors in the attitudes of people toward wildlife (Hariohay et al., 2018; Nath et al., 2015; Røskaft et al., 2007). Educated people tend to hold more positive attitudes toward wild elephants and conservation (Abdullah et al., 2019; Bandara & Tisdell, 2003; Nath et al., 2015; Sarker & Røskaft, 2010). In the survey, those who obtained higher education expressed their expectation that elephant tourism would bring job opportunities, income generation, infrastructure improvements, opportunities for locals to be exposed to visitors, and the potential for foreigners to see wild elephants as well as sustainable elephant conservation. Knowledge and education can generate a positive outlook on nature and wildlife conservation for the future, including for wild elephants. Some educated respondents expressed an attitude that if there are no wild elephants in the forest, deforestation and forest settlement might increase due to easier human access. Education and awareness programs are effective in delivering reliable information to local communities to advocate for conservation. Local people's attitudes can be changed by distributing the right information (Pickens, 2005). It is suggested that education programs should be included in locally adaptable mitigation measures for HEC, and these programs should teach about the ecological, cultural, and religious roles of wild elephants.

Conservation Implications and Recommendations

Overall, local people held positive attitudes toward wild elephants and their conservation. Limited or absent deliberate assistance or mitigation measures for HEC from the Myanmar government, however, caused local people to be more concerned about their livelihoods than about the well-being of wild elephants. This finding indicates that it is difficult to develop conservation willingness among local people if HEC is allowed to persist and no solutions are implemented. As Nilsson et al. (2020) argued, attitudes are not always likely to cause changes in behavior, and behavioral changes are needed if conservation is to be achieved. Motivation and opportunity are important determinants in attitude-behavior processes (Fazio, 1990). Despite the lack of major solutions being implemented, there were profound strategic actions (e.g., compensation or insurance schemes, and development of local HEC management mechanisms) to mitigate HEC described in the Myanmar Elephant Conservation Action Plan 2018–2027 (MECAP). It is of utmost importance to expedite the implementation of the MECAP by empowering local communities, thereby allowing them to change their behaviors toward elephant conservation, and by ensuring the active participation of local communities in HEC resolutions.

It is also recommended that the government and conservation organizations take more responsibility and focus on addressing and mitigating HEC before community tolerance of HEC is aggravated and the population of wild elephants becomes a bottleneck in the country. It is vital to consider the sociodemographic conditions of local people in planning

and designing conservation actions for wild elephants as well as in HEC mitigation. The assessment of local people plays an important role in better understanding their attitudes toward HEC and how to incorporate them for improved collaboration.

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ORCID

Zaw Min Thant http://orcid.org/0000-0001-7481-1664
Roel May http://orcid.org/0000-0002-6580-4064
Eivin Røskaft http://orcid.org/0000-0003-0262-8443

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