Local people's attitudes and perceptions of dholes (Cuon alpinus) around protected areas in southeastern Thailand

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Research Article

Local people's attitudes and perceptions of dholes (*Cuon alpinus*) around protected areas in southeastern Thailand

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Abstract

Large carnivores such as dholes (*Cuon alpinus*) have been persecuted and eradicated from certain areas because of the perception that they pose significant threats to livestock. We conducted interviews to examine which variables predict local people's attitude towards dholes. We opportunistically sampled 791 respondents (≥ 18 years of age) in 34 villages that were within 10 km of one of seven targeted protected areas in southeastern Thailand. We used Random Forests to analyze responses to 20 questions concerning respondent demography; knowledge of, perceived occurrence of, and personal attitudes toward dholes; and frequency of forest visits. Respondents agreed dholes should be eliminated based heavily on whether or not they 1) considered dholes dangerous and 2) believed dholes will attack a person. Most villagers, however, held neutral or positive attitudes toward dholes; only 12% of participants stated that dholes should be eliminated in the wild. Overall, we found an encouraging social climate for dholes in Thailand. Our findings support the need for enhanced efforts to teach people to distinguish dholes from jackals (*Canis aureus*) and to encourage students to experience nature.

Key words: carnivore, conservation, interviews, local knowledge, surveys

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Introduction

Public support for carnivore conservation is complex and complicated by historically widespread anecdotes that portray predators as a nuisance and instill fear of attacks on livestock, pets, and people [1]. The offending animals are not often observed in the act, and blame for the damage or attack is sometimes attributed to the wrong species [2, 3, 4]. These challenges support why conservation managers must increase efforts to understand local citizen attitudes and perceptions toward wildlife, especially since endangered species protection often relies on support from local communities [e.g., 5, 6]; as is the case for the endangered dhole (*Cuon alpinus*).

Dholes are a social, pack-living species that prefer to hunt large to medium sized ungulate prey. They are native to South and Southeast Asia and occur across a wide range of land cover types, including tropical dry and moist deciduous forest, evergreen forest, scrub forest, grassland, and alpine steppe. Dholes have been historically persecuted throughout their range and are often perceived by local citizens as nuisance predators and livestock killers. This perception has led to retaliatory killing by humans, and the subsequent eradication of many dhole populations throughout Asia. Dholes were regarded as "pests of the jungles," and were trapped, shot, or poisoned [7]. Reports from the early 1900s spread negative stories of dholes and listed effective strychnine (a conventional predator poison) dosages for their extermination [8]. As late as 1972, the government of India paid bounties for dhole pelts [9], and in the 1980s, government officials and farmers in Bhutan poisoned dholes until the species was extirpated from the country [10]. In Thailand, managers in Khao Yai National Park (KYNP) recently reported an increased number of dhole sightings, concluded that the population was increasing, and became concerned that dhole packs might attack tourists and have a negative effect on sambar deer (*Rusa unicolor*; pers. comm. P. Wohandee [prior Superintendent at KYNP]). Senior managers debated culling as an option to curtail dhole populations, highlighting the impact of negative attitudes on ad-hoc approaches to managing the endangered canid.

Dholes are found in several protected areas in Thailand and perhaps in areas outside the parks [11]. Despite their extensive distribution and occurrence in human-use areas, their role as livestock predators and people's perception of them have not been assessed. Here we report on interview surveys assessing local people's knowledge about dholes and their perceptions of dholes as "nuisance" predators. We examine how geography, education, demography, and economics affect conservation attitudes toward these predators by people who live adjacent to national parks and wildlife sanctuaries in southeastern Thailand.

Methods

Study Area

From May 2007 through August 2009 we conducted interview surveys in villages adjacent to seven of Thailand's protected areas (Fig. 1). Primary habitats include moist evergreen forest, mixed-deciduous forest, dry deciduous, and dry evergreen forest. On average, the region receives <1,000 mm precipitation per year [12]. Adjacent to protected areas are numerous villages with agricultural areas that mostly include cassava fields and eucalyptus plantations.

Our study areas included Khao Yai National Park (KYNP) and six wildlife sanctuaries: Dong Yai (DY), Khao Ang Rue Nai (KARN), Huai Sala (HS), Huai Samran (HSM), Huai Tabtan (HT), and Phanom Dongrak (PD). Khao Yai National Park (2,168 km^2) was the first national park established in Thailand and has been a major

focus for tourism and long-term wildlife monitoring programs [13, 14, 15, 16, 17]. Khao Yai National Park and Dong Yai Wildlife Sanctuary (DY) are both part of the Dong Phayayen-Khao Yai Forest Complex, a UNESCO World Heritage site that combines five protected areas, totaling 6,155 km^2 [18]. Khao Ang Rue Nai Wildlife Sanctuary covers 1,079 km^2, and the absence of a buffer zone increases the likelihood of direct human-wildlife interaction.

The other wildlife sanctuaries to the east follow the Phatam-Khao Phanom Dongrak ridgeline running along the border of Cambodia. We included these areas to fill a knowledge gap because most previous studies or surveys of carnivores focused on western Thailand, omitting protected areas near the Thai-Cambodian border. Although there are frequent reports of illegal logging from these reserves [19], some of the areas may have lower wildlife poaching rates due to the presence of land mines [20].
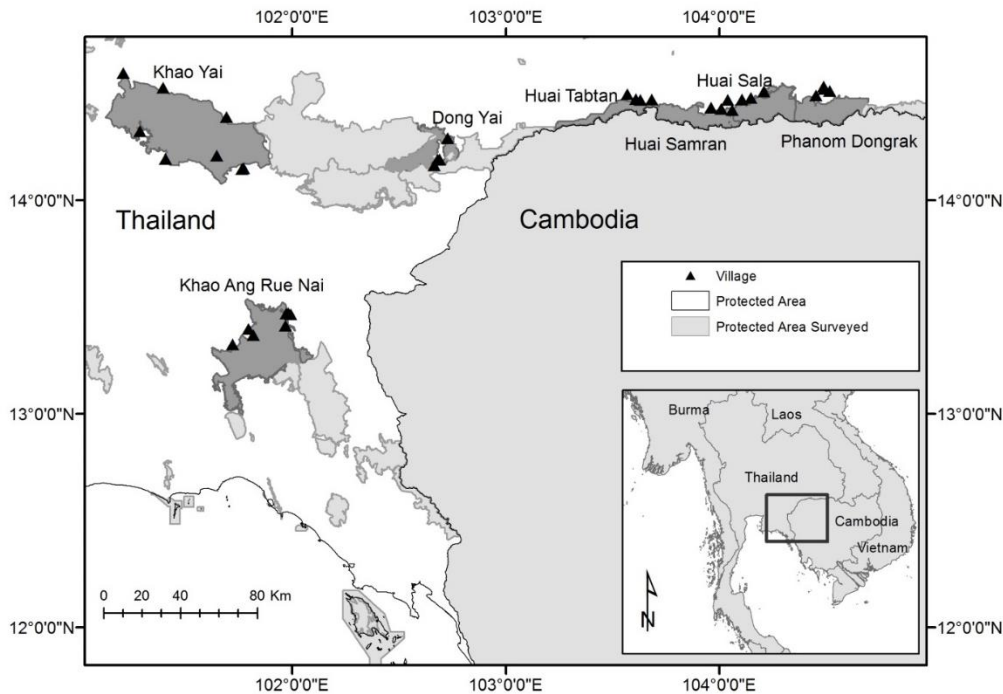

Fig. 1. Protected areas and communities surveyed for conservation knowledge and attitudes toward dholes in southeastern Thailand from May 2007 through August 2009.

Sampling
We conducted verbal interviews of 791 people [21]. All interviewees were ≥ 18 years of age and resided in one of 34 villages within 10 km of one of the seven targeted protected areas. These villages varied in size (~100-400 households) but all were rural, with the majority of households subsisting on agriculture and cattle production. We systematically sampled villagers by including at least three villages bordering each protected area and by asking village headsmen to congregate members in the morning before work. To sample older adults and non-workers, we interviewed people who were at home in the afternoons. We tried our best to obtain an equal number of interviews from both male and female respondents. Each

respondent was interviewed separately, and we talked to only one person from each household to ensure independence of data collected.

Table 1. Variables included in the analysis to characterize attitudes towards dholes.

Variable	Question
Age	Age of respondent in years
Attack Livestock*	If given a chance, dholes will attack livestock
Attack Person*	If given a chance, dholes will attack a person
Crops	Owned crops (1) or did not own crops (0)
Dangerous*	Dholes are dangerous
Dhole ID	Did the respondent correctly identify a photograph of a dhole?
Dhole Kill	Are you aware of any situations in the last year where dholes killed livestock?
Distance	Distance (m) of respondent's village to protected area boundary
Income	Eight household income categories
Park	Closest protected area
School	Year of highest level of school attended
Seen Dholes	Have you ever seen a wild dhole in the forest?
Sex	Male or Female
Too Many Dholes*	Dholes are over-populated
Wildlife Problems*	Sometimes wildlife causes problems for me and my family

*Respondents were asked how much they agreed with the statement measured on a Likert scale.

The Survey Instrument

Students from Kasetsart University and research assistants from KARN conducted structured interviews in Thai, the national language. To maintain high data quality and prevent interview bias, the principal investigator trained all of the assistants prior to the survey. The interviewers were blind to the study emphasis, were asked to record answers exactly as given, and were reminded not to react to answers or change content or wording when clarifying questions. We introduced the survey to villagers by explaining that the purpose of the interview was to understand the public's knowledge and opinions about wildlife. Dholes were not mentioned as a focus of our study. We emphasized the confidentiality of the interview and the anonymity of the respondents by explaining that raw data or individually identifiable responses would not be shared with anyone. Surveys were approved and certified through the University of Massachusetts Institutional Review Board (IRB #06239).

Questions on the survey were carefully planned and piloted to reduce bias from leading questions, ambiguous questions, and cultural differences [22]. After piloting the interview protocol with 30 villagers around KYNP in May 2007, we worked with Thai students to revise and modify the questions as necessary for clarification. The final protocol consisted of a combination of multiple choice response (nominal data, yes/no data, socioeconomic background questions), ranking, and open-ended questions. A subset of the complete questionnaire was used for this analysis and included questions involving the identification of canid photographs and a number of questions to understand attitudes toward dholes (Appendix 1).

Interviewers asked villagers to identify color photographs of a dhole, an Asiatic jackal (*Canis aureus*), and a maned wolf (*Chrysocyon brachyurus*); we included a photograph of a maned wolf from South America (similar in coloration to dholes) to test whether or not respondents could correctly pick out a non-native species. For each picture, respondents were asked if they knew the name of the animal, whether they had ever seen this animal, whether they thought the animal was found in the surrounding forest, and how they believe the numbers of the animal have changed over the last ten years.

We used a 5-point Likert scale [23] for most questions measuring conservation attitudes. To clarify the response options, the five categories ranging from "strongly disagree" to "strongly agree" were written in Thai on a sign that was given to each respondent. The interviewer made a statement such as "dholes are dangerous" and the respondent was asked to specify their level of agreement by choosing one of a given response category.

Data Analysis
We used Random Forests, a type of recursive partitioning method available in the 'party' package [24] in the programming language R version 3.0.1 [25]. While other methods such as CART are generally used for analyzing similar data, in our experience Random Forests have substantially outperformed methods based only on a single regression tree. We also chose to implement cforest in the 'party' package instead of using other packages (e.g. 'rpart' and 'randomforest') because it is appropriate to use with predictor variables of different types. A conditional variable-importance measure (function 'varimp') has recently been added to this package, which can give more reliable results when evaluating the importance of each variable if predictor variables are correlated [26]. This is important with the high number of correlated predictor variables in interview surveys. The 'party' algorithm first tests whether predictor variables are independent of each other and independent of the response variable. It then selects the single predictor variable with the strongest association to the response variable and assigns a p-value to the relationship. The data are then split into two nodes (groups of data) that are compared to the predictor variables in a repeat search for the next predictor variable with the strongest association. This portioning of the data continues until the assigned stop criterion.

Model parameters included 1,000 trees, and we set the number of randomly preselected predictor variables for each split (*mtry*) to four. An *mtry* of four was chosen because Strobel et al. [26] suggest using the square root of the number of variables. The stop criterion was set to the default by Strobl et al. [27] and is based on the univariate p-values. Before we interpreted the random forest variable importance rankings, we increased the number of trees from 20 to 500 to 1,000, and repeated the analyses specifying different values for random seeds. The results of significantly ranked variables were stable and the overall results were the same. Variables are usually considered informative if their variable importance value is above the absolute value of the lowest negative-scoring variable [26].

We included 15 factors as potential explanatory variables. Five variables were chosen to characterize attitudes towards dholes and included the level of agreement with statements based on a 1-5 Likert scale; three variables dealt with people's familiarity with dholes; three variables were chosen to indicate people's relationship to the forest; and the remaining variables were age, sex, level of schooling, and income (Table 1; Appendix I).

The degree to which people agreed that "We should eliminate dholes" was chosen as the response variable. The variable was an ordered factor of the Likert responses on a 1-5 scale indicating level of agreement with the statement. We were most interested in identifying variables correlated with this outright elimination statement, because we assumed that people with extremely negative attitudes would be most likely to act and have a detrimental impact on dholes.

Results

Respondent Socio-Demographics

We used ArcGIS version 9.3 (ESRI Inc. Redlands, USA) to determine that the average distance respondents lived from the nearest protected area was 1.6 km (range 0-3.8 km; Table 2). Respondent populations were fairly homogeneous with respect to average age (46 yr.) and gender (51% males; Table 2). The majority (81%) of respondents finished primary school through level six, and 58% reported an income of <60,000 Baht (ca. $USD 2,000) per year (Table 2). The highest percentage of respondents indicating that they grew crops was at KARN (79%) and the lowest (30%) was at KYNP (Table 2).

Table 2. Demographic data for interview respondents from surveys conducted between May 2007 and August 2009 in Thailand.

Protected Area (PA)	Date	No. of villages	Distance to PA (km)	Total surveyed	Males	Females	≥6 Years of School	Income < 60,000 Baht	Grow crops
Dong Yai	Jul-Aug 2009	4	1.0	100	36	64	68	54	58
Huai Sala	Jul-Aug 2009	4	1.0	102	45	57	90	78	48
Huai Samran	Jul-Aug 2009	3	2.4	82	42	40	70	52	28
Huai Tabtan	Jul-Aug 2009	4	2.3	121	55	66	92	80	60
Khao Ang Rue Nai	Nov 2007, Mar 2008	7	0.0	200	144	56	183	97	157
Khao Yai	May 2007	8	1.0	87	36	51	53	37	26
Phanom Dongrak	Jul-Aug 2009	4	3.8	99	49	50	87	60	57
TOTALS		34	1.6 (avg)	791	407	384	643	458	434

Familiarity with Dholes

Very few people were able to correctly identify dholes from a photograph (20%) and more frequently labeled the dhole photograph as an Asiatic jackal (32%) or "forest dog" (unknown local wild canid; 27%) than correctly as a dhole (Fig. 2). Jackals were most often identified as jackals (41%) or "forest dogs" (22%) but rarely as dholes (8%). Most respondents (64%) assigned an incorrect name to the maned wolf and 35% admitted that they could not classify the photo. Seven percent of people confused the maned wolf with a dhole (Fig. 2).

Eighty people reported seeing a dhole (10%), including those living adjacent to five protected areas (DY, HT, HSAM, HS, PD) where presence of dholes has not been documented in the peer-reviewed literature. Of the 133 people who answered the question about dhole status, 5% thought that dhole populations were increasing in the area compared to the last 10 years. Thirty-six villagers (4.5%) reported livestock killing by dholes within the past 12 months, and such killing occurred near every protected area. The majority of animals purportedly killed by dholes were chickens (17), ducks (3), calves (3), a rabbit (1), a pig

(1), and a fish (1). Respondents reported one instance of a dhole fighting with a domestic dog and one instance of a dhole killing the pup of a domestic dog.

Half (50%) of the interviewees believed that dholes will attack a person, and a majority (61%) agreed that dholes will attack livestock (Fig. 3). There were slightly more people (51%) who moderately or strongly agreed with the statement that "dholes are dangerous" (Fig. 3). More respondents (38%) agreed than disagreed with the idea that dholes are over-abundant, and only 12% moderately or strongly agreed that dholes should be eliminated from the surrounding forest. Ten variables had a significant variable importance in predicting the degree to which a respondent agreed that dholes should be eliminated (Fig. 4). The two variables of most importance were *Dangerous* and *Attack Person*.
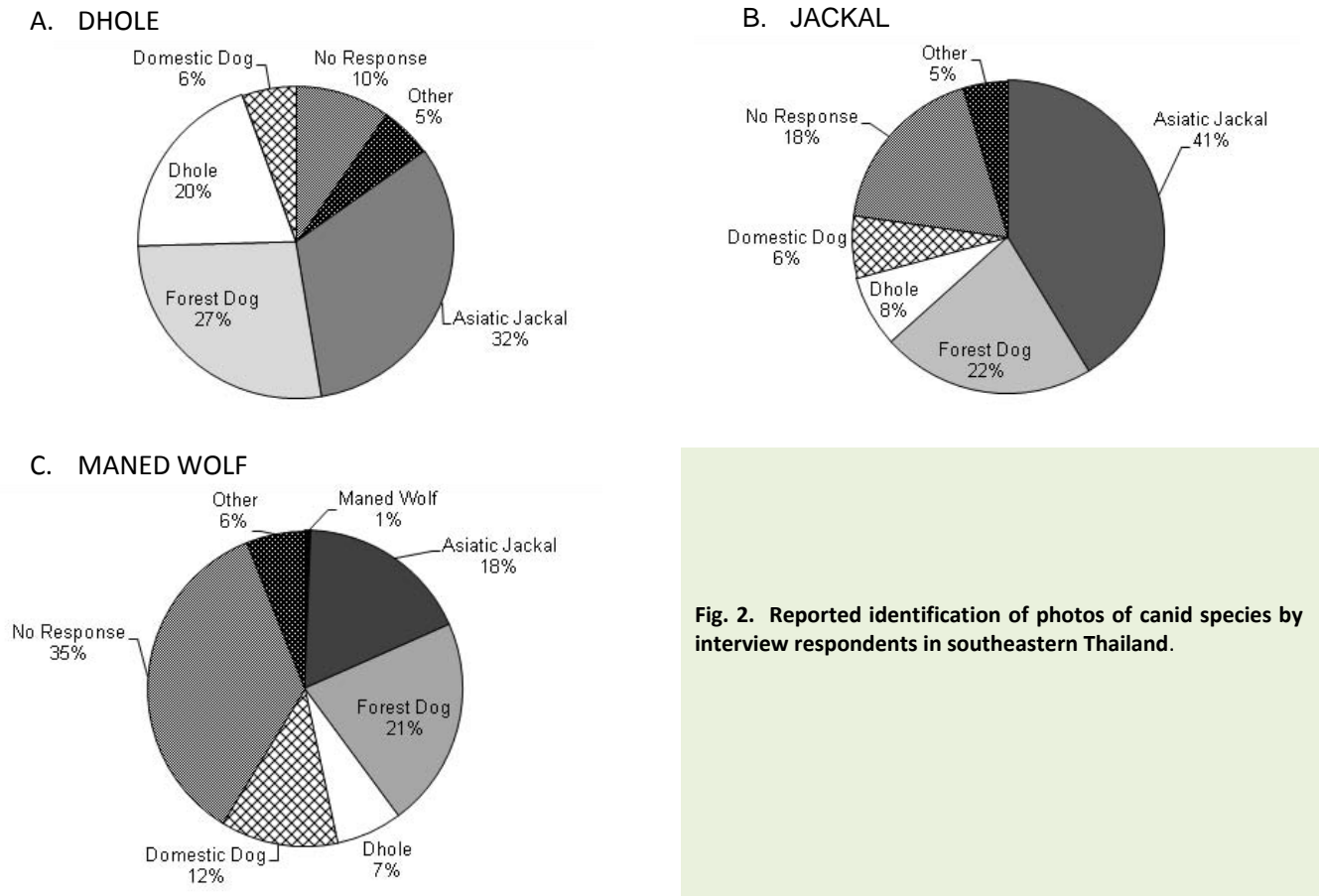

A. DHOLE

B. JACKAL

C. MANED WOLF

Fig. 2. Reported identification of photos of canid species by interview respondents in southeastern Thailand.

Discussion

We are cautiously optimistic about the current status of dholes in Thailand, based on the following findings: confirmation of dhole presence in five wildlife sanctuaries where the species was previously undocumented in the literature, interviews with villagers indicating dhole populations may have been stable over the past decade, and few reports of livestock predation attributed to dholes [cf 28]. Human-dhole interactions seem most predominant in areas that lack sufficient wild prey. For example, Lyngdoh et al. [29] reported high livestock predation by dholes in Northeast India where there are low prey

densities because of hunting. This is in contrast to the Western Ghats of India where prey animals are found in good densities and people reported the dhole as one of the least conflict-prone carnivores [30]. We expected a similar scenario to Northeast India due to hunting pressures in protected areas in Thailand. The lack of evidence for dhole predation could be an indication of sufficient wild prey. However, lack of livestock predation could also indicate a generally low number of canids in the area in response to low prey densities. In either case, it is encouraging that we found little human-dhole conflict.
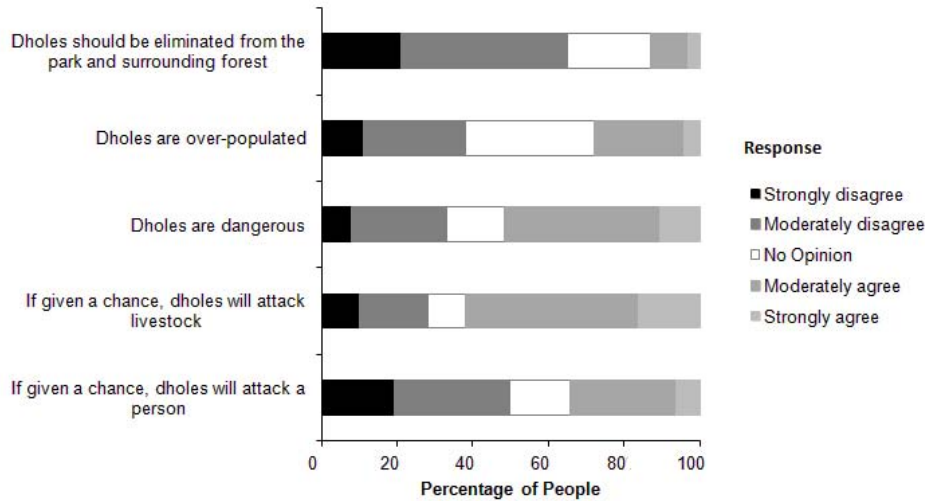

Fig. 3. People's perception of dholes based on interview surveys conducted in southeastern Thailand.

Negative attitudes towards dholes that did persist followed a trend commonly seen in attitudes toward other carnivores, related to people's concern for their own and their family's safety [31, 32] and of livestock [33, 34]. It is common for negative attitudes toward carnivore species to be related to people's fears. But negative perceptions that dholes will attack people and that dholes are dangerous are skewed, because there has never been a report of a dhole attacking a person anywhere.
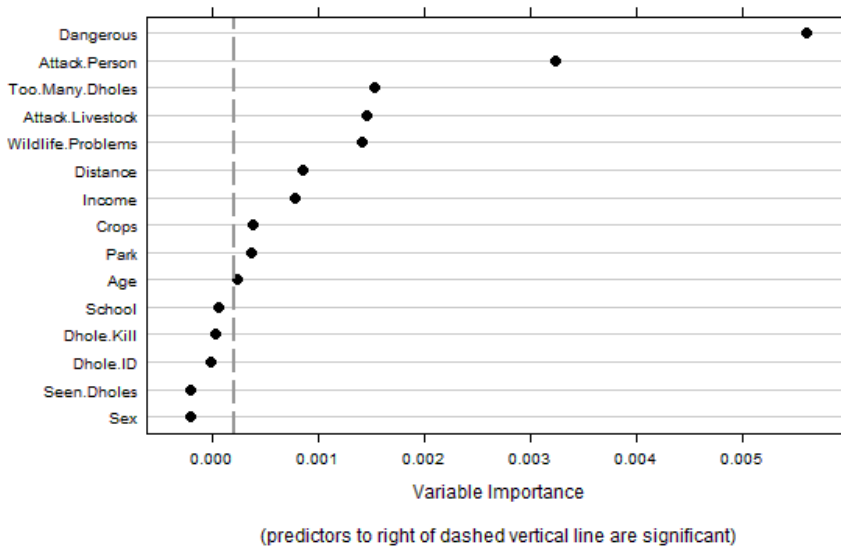

Fig. 4. Random forest output identifying variable importance in predicting whether or not interview respondents agreed with the statement, "We should eliminate dholes."

People are more likely to view carnivores positively when they have greater knowledge and personal experience with them [35, 36, 37, 38]. To maintain a positive social climate for dholes in Thailand, protected area managers must help people appreciate local wildlife and alleviate fears that they may attack humans. They should communicate the low risk of being attacked and "good examples" of the importance of carnivores in the ecosystem [36, 37, 38]. However, only providing information about the low risk of being attacked by carnivores does not necessarily reduce fear, because such information from non-native conservationists often is not believed [32]. It may be more beneficial to encourage people to gain personal experience with carnivores [32, 39] and to teach them appropriate behavior around wild animals. This approach has previously been applied successfully to reduce peoples' fear of brown bear (*Ursus arctos*) and wolf (*Canis lupus*) in Sweden [40].

On a more basic level, our results indicate a lack of knowledge concerning local wildlife. We observed significant misidentification of dholes during our interview surveys. Most people had trouble identifying dholes, and consistently confused dholes with Asiatic jackals. Overall, local people do not differentiate between various canids and tended to include dholes, jackals, and maned wolf together under the general term of "forest dog." However, they were able to separate domestic dogs from wild canids. People who lump all wild canids into a general "forest dog" category might also lump all negative interactions with wild canids together. Therefore, the first step to cultivating a positive social climate for dholes in Thailand is to teach people the physical, behavioral, and ecological-niche differences between dholes and jackals. We highly recommend the development of education materials that pictorially differentiate dholes and Asiatic jackals.

Conclusions about wildlife status must be regarded with caution due to false reporting. Interview respondents can be wrong, lie, or hold back full information. For example, we do not know the degree to which they are good judges of population estimates. Furthermore, if an interviewee feels there is a chance that they could be reported to the authorities, they could be less likely to give honest answers. Many of our interviewers were from the same area as the respondents, to help make the respondents feel comfortable. To increase the reliability of our responses, the interviewers stated at the beginning that the respondent's name was not being put on the data collection form. When asking detailed questions about wildlife, interviewers handed the respondent a photograph of a dhole and said, "this is a dhole," so it was clear which animal was the focus of the question.

Fig. 5. Photographs of a dhole ("Cuon.alpinus-cut" by en: User:Kalyanvarma, Wikimedia Commons), Asiatic jackal (K. Jenks), and maned wolf ("Maned wolf-aguara guazu", Wikimedia Commons).

Implications for dhole conservation

Dhole distribution is most influenced by prey distribution and abundance, but anthropogenic activities also affect their distribution [11, 41]. Although using local knowledge has limitations, the process of engaging local people promotes collaborative action that large mammals in Southeast Asia need for adequate protection [42]. We found a large contingency of villagers who held positive attitudes toward dholes. Furthermore, there were no reports of dhole attacks on humans and relatively few instances of livestock predation. This is a positive social climate for boosting efforts to disseminate information about the role of dholes in the ecosystem. Because people see all wild canids as "forest dogs," the first step is the development of education materials that pictorially differentiate dholes and Asiatic jackals (Fig. 5). However, perceived problems and irrational fears (seldom supported by evidence) play a large role in influencing conservation attitudes. Therefore, we may be able to improve conservation efforts by incorporating more ecology training into local school curricula, training protected area staff in educational outreach, and encouraging students to experience nature. This would dispel some of the false notions that result in people being afraid of dholes and enhance understanding of why dholes are important to the ecosystem.

Acknowledgements

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APPENDIX I. Subset of questions from interview survey used in analysis.

Interview No. _____   Date _____

Interviewer _____   Location_____

Time _____   GPS Location _____

(Greeting of your choice). I'm with a research team, and we are interviewing people concerning wildlife protection and management. Can I ask you a few questions that will take less than 20 minutes? Your responses will be kept confidential.

1. What is your gender? ___male ___female
2. How old are you? _____years
3. What is the highest grade or year of school you have completed?_____
4. What is your primary occupation or job? _____
5. Do you grow crops? ___Yes ___No
If yes, what crops do you grow?

____ rice   ____corn   ____beans
____fruit (specify) _____   ____other (specify) _____

6. Please look at this card, and tell me which letter most closely represents the amount of money your household made last year before taxes?

A) = 30,000 baht or less   E) = 120,001 to 150,000 baht
B) = 30,001 to 60,000 baht   F) = 150,001 to 200,000 baht
C) = 60,001 to 90,000 baht   G) = more than 200,000 baht
D) = 90,001 to 120,000 baht   H) = Don't Know

(Hand picture #1 of a **dhole** to respondent)

7. Can you tell me the name of this animal? (List name given)_____
8. Have you ever seen this animal in the park or surrounding forest? ___Yes ___No ___Not sure
9. Do you think the animal is currently found in this protected area? ___Yes ___No ___Not Sure
If YES, Over the last 10 years, how has the number of this animal you have seen in this area changed?

_____ Stable (no change)
_____ Increasing
_____ Decreasing
_____ There are none
_____ Not Sure / Don't Know

(Hand picture #2 of a **jackal** to respondent)

10. Can you tell me the name of this animal? (List name given)_____
11. Have you ever seen this animal in the park or surrounding forest? ___Yes ___No ___Not Sure
12. Do you think the animal is currently found in this protected area? ___Yes ___No ___Not Sure
If YES, Over the last 10 years, how has the number of this animal you have seen in this area changed?

_____ Stable (no change)   _____ Increasing   _____ Decreasing
_____ There are none   _____ Not Sure / Don't Know

(Hand picture #3 of a **maned wolf** to respondent)

13. Can you tell me the name of this animal? (List name given)_____
14. Have you ever seen this animal in the park or surrounding forest? ___Yes ___No ___Not Sure
15. Do you think the animal is currently found in this protected area? ___Yes ___No ___Not Sure

If YES, Over the last 10 years, how has the number of this animal you have seen in this area changed?

_____ Stable (no change)   _____ Increasing   _____ Decreasing
_____ There are none   _____ Not Sure / Don't Know

Thank you. Now, I am going to ask you specific questions about dholes.

(Hand picture #1 to respondent)

Tell the respondent: This is a dhole.

16. Have you *ever* seen this animal in the protected area or surrounding forest?
___Yes   ___No   ___Not Sure   ___Can't Remember

17. Within the last 12 months, have you personally seen dholes in the protected area or surrounding forest?   ___Yes   ___No   ___Not Sure   ___Can't Remember
If yes, how many times? _____ times
If yes, Can you tell me all of the locations where you have seen a dhole or dholes in the past 12 months? _____

18. Over the last 10 years, how has the number of dholes you have seen in the surrounding area changed?

_____ Stable (no change)   _____ Increasing   _____ Decreasing
_____ There are no dholes   _____ Not Sure / Don't Know
Reason for the above answer? _____

19. Within the past 12 months, are you aware of any situations where dholes have killed livestock?
___Yes   ___No   ___Don't Know
If yes, what type of livestock was killed? Species_____
How many were killed or injured? _____ number
Where did this incident happen? _____

(Hand 1-5 scale to respondent)

On the scale I gave to you from 1 to 5, 1 means you strongly disagree with the statement I will read to you, 2 means that you moderately disagree, 3 means that you neither agree nor disagree (you have no opinion), 4 you moderately agree with the statement, and 5 means that you strongly agree with the statement. Do you have any questions about how to use this scale?

Please respond to the following statements based on the 1-5 scale.

	Strongly disagree	Moderately disagree	No opinion	Moderately agree	Strongly agree
1. If given a chance, dholes will attack a person	1	2	3	4	5
2. If given a chance, dholes will attack livestock	1	2	3	4	5
3. Dholes are dangerous	1	2	3	4	5
4. Dholes are over-populated	1	2	3	4	5
5. We should eliminate dholes	1	2	3	4	5

6. Sometimes wildlife cause problems
for me and my family   1   2   3   4   5

20. Within the last 6 months, how many trips did you make into the forest of the adjacent protected area (for any reason)? _____trips