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Understanding people's perception and attitudes towards mammalian fauna using qualitative data: a case study in Barail Wildlife Sanctuary, India

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Abstract: A concise interpretation of people's perception and attitude towards wildlife helps in formulating better long-term conservation policies. In an attempt to understand people's perception, we considered one of the threatened and least known ecosystems of northeastern India, the Barail range, mainly focusing on the Barail Wildlife Sanctuary, the only protected area of this range, and falls in the Indo-Burma biodiversity hotspot area. The sanctuary is known for a high diversity of mammals, mainly primates (with seven reported species), and bears (with three of the eight globally known species—a diversity not met elsewhere in the globe). To protect its pristine wildlife wealth, it is essential that the perception of the local settlers is elucidated, and this prompted us to take up the present study. In this study, we used open- and close-ended questionnaire, which was then coded (yes/positive=1 and no/negative=0). Each response was thoroughly examined using logistic regression and variables like socio-economic factors, knowledge of the sanctuary, wildlife and forest management were found to generate positive perception towards the sanctuary and its wildlife, and vice-versa. Further, alternative means is suggested in terms of tourism, and the attitudes towards instigation of tourism were mostly favoured by the locals. Besides promoting tourism, providing alternative livelihood and vocational trainings for the locals and, timely compensation for the losses caused by the animals should be long-term strategies for the conservation of the mammals of the sanctuary. It has been increasingly recognized that involvement of locals is a prima facie requirement in the conservation of wildlife, and as such their perception is of great significance. While the study was conducted at the Barail Wildlife Sanctuary, the results may translate in other protected areas, and may be referred to as a model strategy for other protected areas having similar scenario.

Keywords: Assam, Barail range, conservation, northeastern India, threatened habitat.

সার-কথাঃ দীর্ঘ-মেয়াদি সুফল প্রদানকারী এবং অপেক্ষাকৃত ভালো বন্যপ্রাণী সংরক্ষণের পন্থা-পদ্ধতি নিরূপণের লক্ষ্যে বন্যপ্রাণীদের বিচরনভূমির আশেপাসে বাস করা সাধারণ মানুষের উপলব্ধি এবং মনোভাব অধ্যয়নের উপর ভিত্তি করেই এই গবেষণা করা হয়েছে। অপেক্ষাকৃত কম অধ্যয়িত অভয়ারন্যে এই গবেষণা চালানো হয়েছে, এবং 'ইন্দো-বার্মা উষ্ণ জৈববৈচিত্র্য' এলাকার অন্তর্গত এই 'বড়াইল অভয়ারন্য' আসামের বরাক উপত্যকায় থাকা একমাত্র সংরক্ষিত এলাকা। বিভিন্ন প্রজাতির পশুপক্ষী, সাতটি মুল্যবান (লুপ্তপ্রায় এবং লুপ্ত-পথ-গামী) প্রজাতির বানর, ভাল্লুক, সরীসৃপ এবং অজস্র মুল্যবান প্রজাপতি, কীটপতঙ্গ ইত্যাদির বাসস্থল এই অভয়ারন্য। এতোগুলো মুল্যবান প্রজাতির একসাথে থাকা অভয়ারন্য দেশের অন্যত্র সত্যিই বিরল। অমুল্য বন্য সম্পদে ভরপুর এই অভয়ারন্যের ধারে কাছে বসবাস করা লোকদের স্থানীয় জীবজন্তু সম্পর্কে ধ্যানধারণা বন্যপ্রাণী তথা অভয়ারন্য সংরক্ষনে নির্ণায়ক ভূমিকা পালন করবে, এই প্রত্যাশাটুকু মাথায় রেখেই গবেষণার এই কাজটুকু হাতে নেওয়া হয়েছে। সমীক্ষার কাজে কিছু 'সরাসরি-প্রশ্ন' এবং আরও কিছু 'হাঁ' কিম্বা 'না' ধরনের প্রশ্ন রাখা হয়েছিল। 'হাঁ'-সুচক উত্তরের মান '১' এবং না-সুচকের ক্ষেত্রে '০' ধরে বাকিটুকুর পরিসংখ্যান-গত বিশ্লেষণ করা হয়েছে। 'লজিস্টিক রিগ্রেশন' ব্যবহার করে প্রত্যেকটি পরিবর্তনশীল কারকের বিশ্লেষণ করা হয়েছে। এদের মধ্যে আর্থসামাজিক উন্নয়ন, অভয়ারন্য বিষয়ক জ্ঞান, উদ্ভিদ ও বন্যপ্রাণী রক্ষনাবেক্ষন ইত্যাদি বিষয় অভয়ারণ্যের উন্নতির সহায়ক হিসেবে উঠে এসেছে। এছাড়াও, পরিবেশ-ভ্রমন, বিকল্প জীবন-যাপনের পন্থা, বন্যপ্রাণী দ্বারা ক্ষতিগ্রস্ত লোকেদের উপযুক্ত ক্ষতিপুরন দান ইত্যাদি অভয়ারণ্যের উন্নয়নে দীর্ঘমেয়াদী সহায়ক হবে বলে গবেষনায় উঠে এসেছে। স্থানীয় লোকেদের সদর্থক সহায়তা ছাড়া অভয়ারণ্যের উন্নয়ন সম্ভব নয়, এই 'নিগুঢ়-সত্য' টুকু বিভিন্ন বিশ্লেষনে বারে বারে উঠে এসেছে। যদিও এই সমীক্ষা ভারত তথা আসামের বড়াইল অভয়ারন্যে চালানো হয়েছে, কিন্তু প্রত্যাশা করা হচ্ছে, উন্নতমানের সংরক্ষনের উদ্দ্যেশ্যে এ ধরনের সমীক্ষা দেশের তথা বিদেশের অন্যান্য অভয়ারন্য এবং জাতীয় উদ্যানেও এই ধরনের 'মডেল-সমীক্ষা' সংরক্ষনের সহায়ক হবে।

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INTRODUCTION

With growing human population and concomitant increased demand for agricultural land and forest produce, the incidences of human-wildlife negative interactions and reclamation of forest land have increased, and thus implementation of effective wildlife conservation legislatures and policies are at bay. India is the second most populous country in the world with human population density of 323 people per km^2 (Census 2011). Fortunately, India also has the largest constitutional framework of law in the world for protecting the rights to live for people as well as wildlife. Among the government polices like, the National Forest Act (1988), and Schedule Tribes and other Forest Dweller Recognition Act (2006) have legitimized the rights of the people especially tribes, for the settlement inside or at the fringe of forest, and utilize its resources. Likewise, Forest Conservation Act (1980) prevents excessive lumbering or extraction of natural resources from reserve forests, wildlife sanctuaries, and national parks. With such policies in place and on the contrary, burgeoning human population, it is very difficult to implement conservation strategies effectively. This is mainly because sudden restriction in the use of forest resources or eviction from inside or vicinity of the protected areas may create conflict among forest dwellers and the government machineries (Mukherjee & Borad 2004). Attitude of the people living around or inside the forest is very significant in implementation of conservation policies or management actions (Winter et al. 2005). Attitude, however, vary inevitably depending upon several factors. While benefits from the forest (e.g., collection of timber and non-timber forest products) create positive attitude, loss of assets (e.g., crop foraging and depredation of livestock by wildlife) generates negative attitude (Walpole & Goodwin 2001; Talukdar & Gupta 2017). Moreover, education, awareness, age and socio-economic status can largely influence the attitudes (Karanth et al. 2008). Since people's perception and attitude towards forest and wildlife significantly influences effective wildlife conservation (Soto et al. 2001; Sundaresan et al. 2012), a thorough understanding of the factors influencing the perception is most important in developing management actions and implementing policies both at local and national levels. In addition, it promotes public awareness regarding the importance of forest and its resource (Gillingham & Lee 1999; Soto et al. 2001; Kaltenborn et al. 2006).

Keeping this in the backdrop, the present study was conducted in the Barail Wildlife Sanctuary (BWS) in Assam, India, an eco-sensitive zone, to elucidate people's perception towards the forest and its wildlife. This sanctuary forms a part of the Barail range, in the Indo-Chinese sub-region and Indo-Burma biodiversity hotspot (Myers et al. 2000). It is one among the few remaining tropical forests of India (Pawar & Birand 2001; Choudhury 2013a), and the only protected area in southern Assam. A complex network of small and large streams along with diverse forest types makes the sanctuary an ideal habitat for mammalian fauna. The sanctuary is known to shelter a high diversity of primates and bears. This includes threatened species like Hoolock Gibbon *Hoolock hoolock*, Stump-tailed Macaque *Macaca arctoides*, Pig-tailed Macaque *M. nemestrina*, Capped Langur *Trachypithecus pileatus,* Bengal Slow Loris *Nycticebus bengalensis*, Assamese Macaque *M. assamensis*, and Rhesus Macaque *M. mulatta* (Choudhury 1997, 1988, 2005, 2013a, 2016; Mazumder 2014). Further, the Barail range and its adjoining areas, form an unique bear kingdom, with three out of eight globally known species (Choudhury 2011, 2013a,b, 2016), including Malayan Sun Bear *Helarctos malayanus*, Sloth Bear *Melursus ursinus*, and Asiatic Black Bear *Ursus thibetanus*. Besides, various species of small carnivorous, ungulates and rodents are also reported from the sanctuary (Choudhury 2013a). The adjoining areas of the BWS, however, are densely populated including habitations and agricultural fields, and thus the chances of exploitation are obviously higher (Pawar & Birand 2001). Thus, conserving the wildlife wealth of the sanctuary would be a difficult venture without the active participation of the locals.

In view of the above issues, we assumed that socio-economic factors, knowledge of the sanctuary, and forest management influence the perception of the locals towards conservation of the sanctuary. Further, we also tried to assess the perception towards mammals of this sanctuary, for which we assume that losses by animals, income status and knowledge of wildlife may largely influence their perception. Our endeavor had been to understand the perception of the local people towards the sanctuary and its wildlife; so that we can suggest some recommendations for effective long-term conservation.

METHODS

Study area

Barail Wildlife Sanctuary is located in the Cachar District of Assam, India. Sprawled over an area of 326.24km^2, BWS is bounded by the Indian state Meghalaya in the west and north-west, the Dima Hasao District of Assam to the north-east, and Cachar District of Assam in the south and east. The course of the river Jatinga divides the sanctuary into two blocks namely western (Karimganj division) and eastern (Cachar division) blocks. The river Dolu runs from the eastern boundary and the river Boleswar runs from western boundary of BWS. Besides, a network of small rivulets and rapids are widely spread inside the sanctuary. The primary vegetation of the BWS is tropical evergreen, semi-evergreen forest and moist deciduous as well as barren grass blanks (Choudhury 2013a). Champion & Seth (1968) classified the vegetation as Cachar tropical evergreen forest, Cachar tropical semi-evergreen forest, and subtropical broadleaf hill forest.

The present study was conducted in eight sites within the radius of 2km from the sanctuary covering both the eastern and western blocks (Figure 1) as follows:

Eastern block:

1. Indranagar (24.986^{0}N, 92.863^{0}E): This village lies at the southeastern boundary of the sanctuary. The river Dolu runs north to south dividing the sanctuary from this village. Further, the area is characterized by monoculture of *Areca catechu* in the home gardens and *Tectona grandis* as the forest plantation. Perhaps this is the only site where a forest plantation was seen. Amaranagar and Nagar tea gardens surround the village.

2. Telacherra (24.972^{0}N, 92.798^{0}E): It is located to the south of BWS. In order to fulfill our criteria, we restricted the survey to one part of this village called Subangpunjee. The village is formed with the contiguous forest patch of the sanctuary that is vegetation constituted at the buffer zone. Forest patch is relatively dense with mixed forest, mainly bamboo. Home gardens are also common and a small stream called Subang-cherra flows from southeast to northwest along the village.

3. Marwacherra (24.972^{0}N, 92.767^{0}E): The village is located to the southwestern boundary of the sanctuary which is near the Silchar-Lumding highway (NH 27). The area is characterized by monoculture of *Areca catechu* and a few patches of bamboo; vegetable crops and paddy cultivation are prominent here.

4. Bandarkhal (25.057^{0}N, 92.802^{0}E): It is located to the northeastern boundary of the sanctuary and near the Silchar-Lumding highway (NH 27). The area has large rocky stream and streamline forest, which is more dense in its interior. Besides, home gardens and monoculture of wild banana also occur in the area.

Western Block:

5. Daralcherra (24.969^{0}N, 92.635^{0}E): The village is at the south end of the boundary. The area is characterized by degraded forest patch and crop cultivation for home garden.

6. Lakhicherra (25.022^{0}N, 92.487^{0}E): It lies at the southeastern boundary of the sanctuary. The area is characterized by slopes with wild banana plants, *Areca catechu* and home gardens.

7. Isacherra (25.020^{0}N, 92.524^{0}E): This village also lies at the southeastern boundary of the sanctuary, adjacent to Lakhicherra. Fragmented patch of secondary forest along monoculture of *Areca catechu* and home gardens are common in this village.

8. New Malidhar (25.188^{0}N, 92.706^{0}E): This village is located at the western most limit of the sanctuary. The village is formed along the river Boleswor that flows in between BWS and Narpuh Wildlife Sanctuary of Meghalaya. This river demarcates the states of Assam and Meghalaya. Slopes are characterised by monocultures of *Areca catechu*, wild banana plants, and home gardens.

Data Collection

Preliminary survey was conducted with forest officials in order to locate the fringe villages surrounding the BWS between December 2016 and January 2017. Thereafter, we restricted to the randomly selected eight villages which were located within 1–2 km radius from the boundary of the sanctuary. After selecting the villages, detailed survey regarding the perception of villagers towards the forest and the wildlife of the sanctuary was started from January 2017 and continued till February 2018. The purpose of the interview was explained to the respondents, and those who were willing to participate were interviewed. For the convenience, we used the vernacular language, Bengali. Each respondent represented a single household, which were selected randomly from the villages. In this manner, we interviewed at least 50% of the households from each village. Data were collected using close-ended as well as open-ended questionnaires targeting head of the households, people who regularly visit forest, and the local hunters. Majority of the respondents (>97%) were male aged more than 35–40 years. In terms of literacy, all the respondents were able to read and write their name. Most of them (93%), however, had

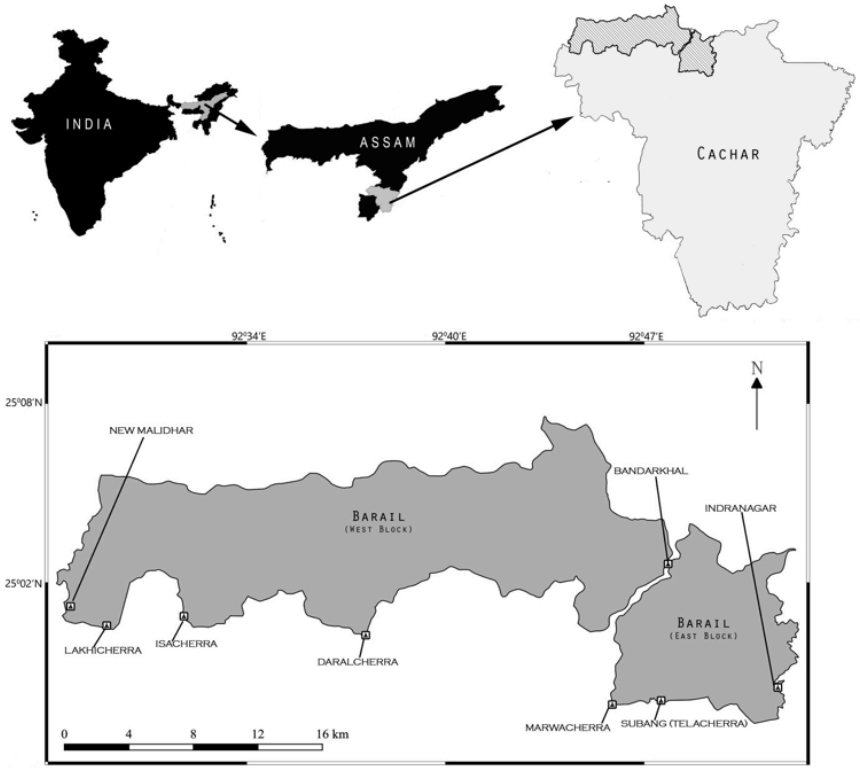

Figure 1. Location of study sites in Barail Wildlife Sanctuary, Cachar (Assam, India). The study sites are marked as 'square box'.

primary education, a few had secondary (4%), and a very few (3%) were graduates. Each of the responses was taken in as 'yes' or 'no'. We also used another ordinal measurement for perception in which, coding was done using 0-1-2 (very less-less-moderate) for income status and 3-2-1 (yes-neutral-no) for tourism.

Data Analysis

Logistic regression models were used to examine relationships between perceptions as dependent variables, and socio-economic factors, knowledge of the forest and wildlife, forest management and as independent variables. Each factor was grouped and codes were assigned for each attribute for the purposes of logistic regression (Table 1). We also assigned codes for each responses (yes/positive=1 and no/negative=0). Multicollinearity among independent variables was checked using tolerance tests (Htun et al. 2012) before running logistic models. Multicollinearity is considered high if the tolerance is lower than 0.2. Data sets were tested to get perception towards the BWS and conservation of the mammals using a hierarchical approach in which socio-economic factors were entered in step one (hereafter referred to as Model 1 and Model 2) and knowledge and forest management variables were entered in step two (hereafter referred to as Model 3 and Model 4) (Htun et al. 2012). For obtaining

Table 1. Respondent's socio-economic status and knowledge towards protection and management of the Barail Wildlife Sanctuary. [INR=Indian Rupees]

Independent variables	Attributes	Percent (n = 287 individuals)
Socio-economic		
Provide settlement	Positive	66.9
Loss by wildlife (Mammals)	Positive	53.3
Accessibility to main road	Good (Located beside the main road)	51.9
	Bad (not accessible directly by main road)	48.1
Income	Very less (<2,700 INR)	5.6
	Less (2,701–5,000 INR)	53.3
	Moderate (> 5,000–12,000 INR)	41.1
Knowledge of the sanctuary		
Aware about the protected area	Positive	57.5
Forest extraction are not allowed	Positive	48.1
Knowledge of forest management		
Aware about forest official activity	Positive	83.6
Relation with forest official	Positive	71.8

the perception about the mammals of BWS, we used two models (Model 5 and Model 6) containing socio-economic variables and knowledge of wildlife. Odds ratios of significant variables were checked to facilitate Model interpretation. Odds ratios greater than 1 indicated increase in the likelihood of the occurrence of the event, and odds ratios less than 1 as decrease in the likelihood of the occurrence of the event (Tabachnick & Fidell 2013).

RESULTS

Perception towards BWS

More than half of the respondents (66.5%) had positive perception with the establishment of the sanctuary. In Model 1, where we tested to run socio-economic factors, the Model was found statistically significant (χ^2=20.01; p=0.001) and correctly classified 79.1% cases (respondents) who believe that the establishment of sanctuary provided legal land for settlement and cultivation around the sanctuary (Table 4). These respondents were likely to have positive perception. Respondents suffering crop loss due to the mammals, however, were associated with a reduction in the likelihood of exhibiting positive perceptions. In Model 2, we incorporated people's knowledge about the sanctuary and forest management, along with Model 1. This Model is significant (χ^2=60.20; p=0.000) and correctly classified 83.4% respondents to bear positive perception towards establishment of the sanctuary. In Model 2, the social-economic variable settlement/cultivation was positively correlated and significant (Table 4). Likewise, Model 2 also showed that people who were aware about the protection of the sanctuary and forest officials' monitoring were approximately 8 times and 2.5 times more likely to have positive perception than those who did not. Loss by animals, however, was not significant in this Model.

Only 47.04% respondents had negative perception towards the establishment of the BWS. When socio-economic variables were entered in Model 3, the model was significant (χ^2 =35.56; p=0.000) and classified 63.8% cases of negative perception (Table 4). The Model shows that people with 'less income' have approximately 17% more chance to have negative perceptions. With increasing crop loss from mammals, increase was the likelihood of negative perception. When the variables—knowledge of the sanctuary and forest management—were added, Model 4 was significant (χ^2 =35.56; p=0.000) and classified 68.9% respondents with negative perception (Table 4). Thus, according to this model, people with 'less income' have approximately 19.4% more chance to exhibit negative perceptions, which is more than Model 3. Again, crop loss caused by mammals was positively correlated to negative perception. People with knowledge of the protected area were more likely to answer that its establishment had not brought any negative impact, but other knowledge variables including forest management were insignificant for the model. Both Models 3 and 4 showed that people having 'bad accessibility to main road' had 42.5% and 34% more chance of increasing likelihood of negative perception. Respondents were more or less satisfied with performance of forest officials. Further, respondents did agree that officials promote conservation, check illegal activity, frequently monitor the sanctuary, and help the locals.

Table 2. Respondent's knowledge towards the wildlife (mammals) and its protection law in India. [INR=Indian Rupees].

Independent variables	Attributes	Percent (n = 287 individuals)
Socio-economic		
Loss by wildlife (Mammals)	Positive	53.3
Income	Very less (<2,700 INR)	5.6
	Less (2,701–5,000 INR)	53.3
	Moderate (> 5,000–12,000 INR)	41.1
Knowledge of wildlife		
Wildlife is beneficial for the forest	Positive	68.3
Wildlife is protected	Positive	80.5

Table 3. Respondent's perception towards Barail Wildlife Sanctuary and its wildlife (Mammals).

Perceptions	Percent positive response (n = 287 individuals)
Barail Wildlife Sanctuary	
Are you happy with establishment of the sanctuary?	79.1
Do you think that the sanctuary does not offer any benefit?	47.0
Wildlife of Barail Wildlife Sanctuary	
Can humans and wildlife co-exist?	66.6
Do you think that wildlife is not beneficial for the people?	39.7

Perception for wildlife of BWS

About two-third (66%) of the respondents had positive perception with respect to co-existence of human and wildlife in the sanctuary. When socio-

Table 4. Predicting odd ratios of people's perceptions (positive and negative) in Barail Wildlife Sanctuary. [Reference group in explanatory variable is not added. *p<0.01; **p<0.05; '+' reference group]

Variables		Happy with establishment of the sanctuary [positive]		The sanctuary does not offer any benefit [negative]	
		Model 1	Model 2	Model 3	Model 4
Socio-economic					
Provide settlement (Yes)		3.026*	2.013*	0.802	0.857
Loss by wildlife (Mammals) (Yes)		0.512**	0.782	2.688*	2.198*
Accessibility to main road (Good)		0.838	0.889	1.425*	1.398*
Income	Very less+				
	Less	0.610	0.665	1.170**	1.194**
	Moderate	0.561	0.571	0.736	0.708
Knowledge of the sanctuary					
Aware about the protected area (Yes)			8.030*		0.454*
Forest extraction are not allowed (Yes)			0.990		1.458
Knowledge of forest management					
Aware about forest official activity (yes)			2.597**		0.857
Relation with forest official (Yes)			0.839		1.184
Percent correctly classified		**79.1**	**83.4**	**63.8**	**68.9**
x^2		**20.001***	**60.208***	**35.561***	**46.459***

economic factors and knowledge of wildlife were run in the model, the model was found statistically significant (χ^2 =203.46; p=0.000) and classified 75.9% cases of positive perception. This model (Model 5) shows that people with 'less income' had 90% chance to have positive perception (Table 5). Also, perception of the respondents having knowledge about the wildlife protection laws and knowledge about the beneficial role of wild animals were positively correlated and significant. Thus, increasing knowledge was associated with increase in the likelihood of showing positive perceptions.

Only 38.67% respondents considered that wildlife is not beneficial. Model 6 was run with socio-economic factors and knowledge of the wildlife, and was statistically significant (χ^2=88.72; p=0.000), classifying 75.02% cases (Table 5). It thus represented that increasing loss by animals were more likely to increase the negative perception, while other variables like income and knowledge of wildlife was not significant, i.e., the loss of crop due to wild animals was the solo variable which determined the negative perception.

Table 5. Predicting odd ratios of people's perceptions (positive and negative) for the mammals of Barail Wildlife Sanctuary. [Reference group in explanatory variable is not added. *p<0.01; **p<0.05; '+' reference group]

Variables		Human and wildlife can co-exist [positive]	Wildlife is not beneficial for the people [negative]
		Model 5	Model 6
Socio-economic			
Loss by wildlife (Mammals) (yes)		1.063	4.455*
Income	Very less+		
	Less	0.013*	1.513
	Moderate	0.490	2.217
Knowledge of wildlife			
Wildlife is protected area (yes)		9.840*	1.161
Wildlife is beneficial for the forest (yes) allowed		6.298*	0.450
Percent correctly classified		**75.9**	**75.02**
x^2		**203.46***	**88.72***

Tourism

From Models 3 and 5, it is evident that income status has significant influence on the positive and negative perceptions towards BWS and its wildlife. All respondents belong to economically backward class, with average monthly income ranging from 3736±877.01 (INR) to 6315±1720.49 (INR) (Mean±SD). Therefore, increasing revenue may eventually increase their socio-economic wellbeing, which in turn may help in reversing their negative perception. One of the common approaches is tourism. In order to find the perception towards tourism, we set a questionnaire in context to

Table 6. People's perception on tourism in Barail Wildlife Sanctuary.

Statement	Positive response (in percentage)								x^2	p	Cramer's V
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8			
Heard about tourism before	35.4	30.9	38.4	32	75.7	50	25.7	82.2	8.04	0.04	0.116
Happy if tourism is encouraged	60.4	42.8	33.3	32	48.4	40	68.5	55.5	10.06	0.01	0.122
Tourism will increase source of income	56.2	30.9	41	32	60.6	45	57.1	35.5	13.51	0.00	0.14
Tourism will not hamper the aesthetic values	75	48	46.1	36	45.4	40	60	54.4	8.82	0.03	0.111

tourism (Table 6). Respondents were asked if they were aware of tourism, and it was found that the majority of the respondents (New Malidhar (82.22%), Lakhicherra (75.75%), Isacherra (50%), and Daralcherra (60.6%)) were aware of it. More than 60% of the respondents of the villages (like Indranagar, Telacherra, Marwacherra and Bandarkhal), however, were unaware of it. For respondents who were unaware, a thorough discussion was conducted about tourism. Then, in subsequent questionnaire session, it was found that the majority of the respondents from Indranagar (56.25%), Daralcherra (68.57%), and New Malidhar (55.55%) villages would be happy if tourism is promoted, while in case of other villages, majority (>40%) were neutral regarding the same. Respondents from Indranagar (56.25%), Lakhicherra (60.6%), and Daralcherra (57.14%) believed that tourism would eventually increase their source of income while more than 45% of the respondents of other three villages had a neutral response. Further, majority of the respondents from Indranagar (75%), Telacherra (59.52%), Marwacherra (56.41%), Bandarkhal (56%), and New Malidhar (64.44%) believe that tourism would cause no harm to their cultural taboos, while more than 54.54% respondents of the other two villages were neutral.

DISCUSSION

Majority of the inhabitants living around the vicinity of the BWS came to this part of Assam from neighbouring hills of Meghalaya, Karbi Anglong, and Dima Hasao for settlement, and their primary source of their livelihood is agriculture. After the declaration of wildlife sanctuary (in 2004) many areas have been restored as protected areas. Consequently, there has been shrinkage of the lands for agriculture due to restriction of the fringe areas of the sanctuary. These settlements with the tribal-dominated population had been converted into revenue village under the provisions of the Schedule Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. Thus, these local communities have positive attitudes towards the sanctuary as such they were benefitted with land for permanent settlement and cultivation, especially 'jhum' (slash & burn) cultivation. People are also of the opinion that some part of the sanctuary should be protected as it conserves resource and reduces hunting of wildlife in this part. Such resolution for settlement does not reduce their problems of living completely, as socio-economic condition of these people is poor. The land allocated to them for settlements and farming is not sufficient. Besides, poor road communication has deprived them from basic requirements. This is the reason why many respondents had negative perceptions, and were of the opinion that state or central government should spend money for the welfare of the people rather than investing on animals and the forest. Further, the respondents had very less choice of livelihood since the sanctuary provides no other opportunities, and in turn increases their dependence on the sanctuary. Therefore, many respondents condemned the decision to not allow the collection of forest products, and respondents are not in full agreement with the spirit of conservation.

In our hypothesis, we assumed that socio-economic factors, knowledge of the sanctuary and knowledge of forest management have large influence and our logistic model, showed the significance of these variables in influencing the perception towards the sanctuary. Similar finding has also been observed in previous studies from other protected areas (Kideghesho et al. 2007; Karanth & Nepal 2012; Htun et al. 2012; Dewu & Roskaft 2018). These results confirm that socio-economic benefit may lead to positive attitudes towards the protected areas while socio-economic problems may lead to negative attitudes. Our logistic model does show significant influence of the income status, measured as monthly income, on their perception; the same is quite low to fulfill their basic requirements. In fact, one of the persistence problems within the local is lacking of social-economic benefit and this is very important in achieving positive attitude for protection of the sanctuary (Oldekop

et al. 2016).

In our Model 5, people around the sanctuary believe that wildlife is beneficial for the forest, and they showed positive attitudes towards the wildlife (mammals) of this sanctuary. Having the traditional values of conservation ingrained in their ethos and belief, they believe in co-existence of both human and wildlife, and understand their importance as well. Further, they know about the wildlife and forest laws. All these factors influence their opinion that hunting is awful. Concurrently, losses caused due to some wild animals have led to negative attitudes. Their agricultural practice mainly includes jhum cultivation, crop production like paddy, potato, tomato, cabbage, and some other vegetables. Crops usually attract wild animals, especially primates like Rhesus Macaque, and others like Wild Boar *Sus scrofa*. Villagers also have monoculture plantations of *Areca catechu*. Species like Hoary-bellied Himalayan Squirrel *Callosciurus pygerythrus* usually nibble on fruits of *Areca catechu* thereby reducing production. Arboreal animals, like primates and squirrels, 'damage'*Piper betel*, and the locals believe that these animals spread a plant disease which dry the plant leaf and vines entirely (locally called 'Utram'—the disease occurs as dark brownish spots in leaf which spreads to the entire plant, ultimately killing the plant). This plant disease, however, occurs due to high rainfall and humidity (Akhter et al. 2013). All these give rise to negative perceptions about wildlife. In such a situation, some people are forced to get rid of these species, and thus, do anything (including killing) just to reduce crop damage. Poachers use such opportunities to kill animals and they also target animals other than crop foragers. Thus, 'problematic' species cause unfavourable attitudes of people for other species as well. Some mentions of the problematic species, in the villages are Wild Boar, Rhesus Macaque, Hoary-bellied Himalayan Squirrel, Indian Muntjac *Muntiacus muntjac*, Jungle Cat *Felis chaus*, Large Indian Civet *Viverra zibetha*, and Small Indian Civet *Viverricula indica*. In fact, the villagers are of the view that these problematic species have increased in number, which may be due to frequent encounters with these species as well as their conservation in the sanctuary. We assume that both awareness of wildlife law and losses by animals would influence the attitudes towards the wildlife of the sanctuary, which is supported by our logistic Model 5 and Model 6 as well. Thus, our findings are in complete agreement with other studies (Kideghesho et al. 2007; Karanth & Kudalkar 2017; Dewu & Roskaft 2018), that losses by animals may eventually lead to more negative perception. Such attitudes were more common to the respondents with more variety of farming.

Tourism can offer significant benefits to this sanctuary in the form of revenue to be used for conservation and management. Simultaneously, it provides benefits for the local communities (Goodwin 1996; Walpole & Goodwin 2001). In the study area, the respondents showed almost unanimous support for tourism. Regardless of their positive attitudes towards tourism, a few local people believed that they would not benefit, as outsiders would take advantage. It is obvious to have such thoughts as people of this area are inexperienced to tourism, however, it also draws our attention to prepare a better plan before initiating this concept of tourism. The planning should support equitable benefits for local as well. Engagement of unemployed youths of the fringe villages in different activities like guiding tourist and researchers will enhance community well-being. Such participation in different field activities would eventually increase their knowledge on fauna and flora present in the sanctuary. These would generate alternative livelihood sources other than agricultural activities, and encourage local people to conserve wild animals. Further, tourism management should be done considering the sentiments of the local people. Overall, positive attitude may be attributable to the early stage of development of tourism locally (Walpole & Goodwin 2001).

The concept of tourism can be further flourished with the introduction of 'homestay'. In this, people offer food and lodging to the tourist in exchange for money. The concept has been recently popularized in many parts of India like Arunachal Pradesh, Sikkim, Nagaland, Assam, Kerala, Uttarakhand and neighbouring Nepal; in the vicinity of protected areas. It eventually catches the attention of many international tourists as they are fascinated with indigenous/ local lifestyle of the host (Wang 2007; Bhalla et al. 2016). Further, structural design of these small houses with vernacular and tradition looks makes them attractive (Singh 1991; Bhalla et al. 2016). Thus, homestays can be an effective step to provide alternative income opportunity for the villagers (Dutta 2012; Bhalla et al. 2016)

So far as the management is concerned, most of the forest officials perform their duties sincerely. Lack of work force and proper equipment, however, poses difficulties. Relations between forest villagers and forest officials is very crucial for implementing any management strategy, as negative relation often gives rise to disputes that may sometimes bring about negative perceptions on wild animals. Under the present scenario, forest officials maintain good relation with local community people and

often help them, this ensures good management.

CONCLUSION

The BWS forms a basis of wildlife conservation in this entire northeastern region of India. The people surrounding the sanctuary had positive and negative perception towards the sanctuary as well as its wildlife. Their perceptions are significantly influenced by their socio-economic factors, knowledge of the sanctuary, and forest management. Losses by animals, income status and knowledge significantly influence their perception towards mammals of this sanctuary. In this context, if problems between the local community and the sanctuary can be resolved or if management strategies are planned to provide benefits to the locals, effective conservation can be done. Severe losses by animals may be mitigated to minimal loss. Such strategies would eventually stand with a hope to reverse the prevailing threats and premeditate for threats in the future. Further, the findings may be used as a model for formulating long-term and effective conservation strategies in other protected areas with similar scenario.

Recommendation

- **Alternative livelihood**—As jhum cultivation is the primary source of their livelihood which is done in the vicinity area of the sanctuary, it may pose a threat to the entire fauna and flora. Therefore, if it is replaced by alternatives like high yielding crop varieties, their income and social wellbeing may be improved, and jhum (slash and burn) cultivation practice may be reduced. The locals may be provided with vocational, technical and skill trainings.
- **Protection to problematic species**—Protection needs to be focused for the 'problematic' species like Rhesus Macaque, Small Indian Civet, Large Indian Civet, Hoary-bellied Himalayan Squirrels, Wild Boar and Indian Muntjac as they are mostly targeted by the people. Negative interactions with these foraging animals can be stopped if the sanctuary management creates an area near the buffer zone of the sanctuary in which food plants are grown. This may reduce crop raiding and improve positive attitudes of the locals. Thus, the locals would not facilitate poachers or hunters.
- **Employment of local people**—Inclusion of people belonging to local community in jobs in the Department of Forest (of both central and state governments) would serve several purposes. For instance, it would improve their socio-economic status thereby decreasing their dependence on BWS, develop a positive perception towards the sanctuary, and importantly since these people are well aware of the area they would be better managers and protectors of the sanctuary.
- **Encouraging Tourism**—Tourism should be encouraged, and funds for small houses for home-stay should be allocated, so that unemployed local people may get involved. This would not only give an alternative source of income but also inculcate the intent of conserving wildlife.
- **Facility to forest officials**—Proper facilities, including arms and ammunitions, should be supplied to the forest officials and guards to enable them to better monitor.
- **Awareness**—Mass awareness campaigns must be conducted involving locals, political leaders, media persons, NGOs and administration, and locals especially school-going children and youths should be made aware of the ecosystem services, wildlife laws, etc.

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