

Culture, Conflict and Conservation

Exploring Human-Macaque Conflict in rural Assam, India



© B. Konwar

Maan Barua

School of Geography and the Environment

University of Oxford, UK

Research Funded by **The Primate Society of Great Britain**

Extended Abstract

Human-macaque conflict is an issue that impacts upon both primate conservation and human wellbeing. In India, Rhesus macaques (*Macaca mullata*) cause considerable damage to crops, and to a lesser extent, injury to people. Finding solutions to the issue requires assessments of the extent and scale of conflict, as well as understanding how affected communities view macaques and protection strategies in place locally. Most work on human-macaque conflict in India has been ecological. Research on cultural perceptions and attitudes to macaques is lacking, although this is of vital importance for finding appropriate solutions to conflict. This study examined (1) the extent of damage caused by macaques in rural Assam, northeast India and peoples' perceptions of the severity of conflict. It then explored (2) what cultural perceptions of macaques people upheld and whether they were undermined by human-macaque conflict. Finally, the study sought to (3) look at extant protection measures in place and the solutions that people were willing to adopt. Both qualitative and quantitative interview based methods, as well as rapid appraisals of conflict were conducted in three affected villages between June and August 2009. Qualitative data was analyzed thematically to unravel key themes and patterns. Quantitative data was analyzed using descriptive statistics and non-parametric tests. The study found that the extent of crop damage in the focal villages was high and affected men and women differently. A majority of the respondents felt conflict was an issue of serious concern. Whilst people endowed religious attributes on macaques, such beliefs were undermined by conflict. People made distinctions between macaques in different spatial contexts, i.e. village, temple and forest macaques. Macaques in villages were the least liked, and those in temples were ascribed higher religious attributes. A range of protection measures were in place, but the perceived level of their effectiveness was low. People believed relocating macaques was an appropriate strategy for reducing conflict, but there was uncertainty as to how this should be done. These findings unravel several important dimensions of human-macaque conflict. First, a high amount of overlap between people and macaques is the reason for sustained conflict. Second, cultural values are problematic and cannot be the panacea for finding solutions to the issue. Third, mitigation strategies need careful planning and cooperation of the local community as well as collaborations between different government agencies. A multifaceted approach is needed to address the issue. An intervention-based project is needed to enhance understanding of the effectiveness of mitigation strategies.

Contents

INTRODUCTION..... 4

STUDY CONTEXT..... 6

METHODS..... 7

 Study Design 7

 Data Collection 9

ANALYSIS..... 10

RESULTS..... 10

 What is the extent of human-macaque conflict in rural areas in Assam? How do communities perceive such conflict? 10

 What cultural values and attitudes towards macaques do people uphold, and to what extent is it undermined by human-macaque conflict? 16

 What conflict mitigation strategies have been deployed by people? What solutions to human-macaque conflict are culturally acceptable and logistically feasible? 20

DISCUSSION..... 26

 Extent and perceptions of human-macaque conflict 26

 Cultural values, attitudes and human-macaque conflict 28

 Mitigation strategies and acceptance of solutions 30

CONCLUSIONS..... 32

REFERENCES..... 35

APPENDIX 1: Survey Questionnaire 38

INTRODUCTION

Primates are often cited as significant agricultural pests, which cause considerable damage to field and tree crops, and additionally impose time and energy costs on farmers who have to protect their crops against them (Boulton et al. 1996; Naughton-Treves 1997). Species whose home-ranges and resource use overlap considerably with that of humans, for instance baboons and macaques, are particularly problematic in both Africa and Asia (Hill, 2000; Priston, 2005). In India, three species of macaques (*Macaca mulatta*, *M. radiata* and to a lesser extent *M. assamensis*) are known to cause damage to crops and threaten human wellbeing in urban spaces (Gupta, 2001). There are over 0.3 million Rhesus macaques (*M. mulatta*) in northern India (Malik, 1992), approximately 86% of which live in areas of human habitation. Intensification of agriculture and reduction of habitat heterogeneity has led to a reduction of food sources for macaques in the non-reserve matrix across many parts of India (Sinha, 2001). With their extensive repertoire of cooperative behaviour, opportunistic life-style and non-specialized omnivorous diets, macaques are highly adaptable and take readily to living alongside humans in rural or urban settings (Hill, 2000). Their ability to learn rapidly and behaviourally adapt to different situations makes macaques successful and troublesome when co-inhabiting space with humans.

Mitigation of human-macaque conflict is at the forefront of primate conservation in India today. This not only needs an understanding of primate ecology and behaviour, but also critical engagement with cultural perceptions and attitudes towards macaques and peoples' willingness to accept mitigation strategies (Naughton-Treves, 1997; Lee & Priston, 2005). Studies on human-macaque conflict in India have largely focused on their ecological dimensions or focused on conservation interventions (Imam et al. 2002; Medhi et al. 2007), and cultural aspects are relatively unaddressed (Pirta et al. 1997). Historically, and to the present day, primates in India have engendered a range of different and sometimes conflicting perceptions among people living in proximity to them. For instance, primates are revered and provisioned for in many parts of India, as a companion and even incarnation of the monkey god Hanumān and as a devotee of Lord Rām (Dutt, 1987), at the same time they evoke resentment and retributive action (Kipling 1904; Southwick & Siddiqui, 1998). Whilst there has been anecdotal evidence of

changes in peoples' perceptions of macaques as a result of conflict (e.g. Medhi et al. 2007), there is little systematic study as to what extent people are willing to tolerate macaques in their vicinity and co-inhabit space with these animals.

Research examining the perceptions of macaques in human-wildlife conflict scenarios could significantly enhance the success of environmental programmes in conflict areas and facilitate the development of mitigation strategies that are informed by, and specifically target local peoples' concerns. This study sought to explore cultural perceptions of macaques in a rural setting in Assam, northeast India and whether human-macaque conflict undermined peoples' willingness to conserve macaques. The study sought to examine local solutions to the conflict in order to understand what was culturally acceptable and feasible in the particular human-macaque conflict context. Through this research, the study contributes to the emerging field of 'Ethnoprimateology' that explores the multifaceted ways in which human and nonhuman primates interrelate (Riley & Priston *forthcoming*).

Study Objectives

The project focused on three key questions in order to inform efforts at minimizing human-macaque conflict and developing conservation practice:

- (1) What is the extent of human-macaque conflict in rural areas in Assam, and how do local communities perceive such conflict?
- (2) What cultural values and attitudes towards macaques do people uphold, and to what extent is it undermined by human-macaque conflict?
- (3) What conflict mitigation strategies have been deployed by people? What solutions to human-macaque conflict are culturally acceptable and logistically feasible?

STUDY CONTEXT

The state of Assam is located in northeast India, a biogeographical zone that has been classified as a “Biodiversity Hotspot” (Myers et al. 2000). The state has high primate diversity with up to 8 species being found in the area (Gupta, 2001). Of these species, the Rhesus macaque is perhaps the most common, found throughout towns, villages, temples and forests in the state. It is a federally protected species in India, listed under Schedule II of the Wildlife (Protection) Act, 1972, and is categorized as “least concern” under the IUCN redlist assessment (IUCN, 2010). The people of Assam have a long-standing culture of interacting with macaques, and images / narratives of monkeys and the monkey-god Hanumān litter the histories and culture of the state. Agriculture is the mainstay of the people, and accounts for 69% of the total workforce (Census of India, 2001). The population of 26.66 million is ethnically diverse, with the dominant social group (65%) comprising of an Assamese-speaking Hindu community (Census of India, 2001; Das, 1987).

The study was located in the villages of Chepenakubowa (26.591456°N and 93.437314°) and Durgapur (26.588161°N and 93.428575°E) (Kaziranga), and Bordihingia around Komargaon (26.645644° and 93.761950°) in the Golaghat district of Assam (Fig. 1a). Two macaque troupes (31 and 24 individuals) occurred in the Kaziranga villages and three in Komargaon (22, 27 and 33 individuals). These areas largely comprised of village homegardens, small-holder and large commercial tea estates and agricultural paddy fields. The macaque troupes were free-ranging and their home ranges were largely restricted to the village/agricultural land matrix. There is considerable overlap in resource-use between humans and macaques, and conflict was a serious issue in all the villages studied. Baba Than, a Shiva temple containing a free-ranging troupe of Rhesus macaques was also present in the area.



Fig. 1a: Location of study sites in Assam, northeast India.



Fig. 1b: Rhesus macaques in temple (left); crop-raiding macaque in farm (right).

METHODS

Study Design

Initially, 9 in depth semi-structured interviews were conducted to examine local perceptions of macaques (Browne-Nunez & Jonker, 2008; Barua et al. *in press*). This involved asking people what they personally thought about macaques, cultural associations of the animal, views on crop-raiding and conflict mitigation strategies. Interviews were in the form of a discussion with the respondent(s), and generally lasted for about an hour. Notes were taken during the time of the interview, and later examined to identify themes and patterns.

A questionnaire was then designed to examine the extent of damage caused by macaques, cultural perceptions and attitudes towards macaques, as well as effectiveness and preferences for mitigation strategies. The questions were translated into Assamese and then back translated by an independent translator in order to test the linguistic appropriateness of the survey instrument. The initial item pool was made as broad as possible and the questionnaire was tested through a pilot run. Weak and poorly-defined items were removed and the set of questions reorganized to maintain flow.

The final questionnaire had 27 items (Appendix 1), organized into the following sections:

1. *Cultural attributes*: 3 statements were used to examine what cultural values of macaques people upheld. Respondents were asked to state whether macaques still had these attributes, had them in the past but not anymore or never had these attributes. They were also asked whether these attributes were valid for village macaques, macaques in temples and in forest reserves.
2. *Attitudes towards macaques*: 7 statements were deployed to explore peoples' attitudes to macaques, of which one ("Assam is better off without macaques") was negatively worded. Individuals were asked to rank four different localities (urban areas, villages, temples and reserves) according to their preference for where macaques should live.
3. *Perceptions and extent of conflict*: A range of questions on the extent of the problem, time spent in guarding houses / farms and activities of macaques were asked. People were also asked to list the range of crops that they grew and the amount macaques damaged by macaques annually. A list of protection measures was derived from the initial qualitative interviews, and respondents were asked to rank these according to their effectiveness.
4. *Attitudes to mitigation strategies*: 10 statements / questions were used to examine peoples' attitudes to different conflict mitigation strategies, management options and willingness to contribute towards conflict resolution.

Most statements measuring attitudes or perceptions were measured on a 5-point Likert scale, whilst other questions that involved direct answers were either binary (Yes / No) or open-ended in nature.

Data Collection

Fieldwork was conducted in the sites between June and August 2009. The study was restricted to the Assamese, Hindu-speaking community as they were the most prominent social group in the area. Households were randomly selected in a village and subsequently every third house from there onward was sampled. Only individuals above the age of 18 were interviewed. The objectives of the study were explained beforehand and individuals were asked to either fill in the questionnaires or, as was more often the case, respond to the questions verbally (about 90% of the responses). Clarifications were made if individuals were unsure what a question meant. All interviews were conducted in Assamese, and as the interviewers were native speakers of the language, interpreters were not used. On average, each questionnaire took about 1-1.5 hours to complete. A total of 81 questionnaires (n=81) were completed in the different study sites. The overall response rate was 90% as it was a direct household interview. Some individuals did not take part in the survey due to issues of time and availability.

During the survey, we refrained from asking sensitive questions such as annual income. Our past work in the area also suggested that people were not likely to give reliable answers to this question. Instead, the relative wealth of a family was gleaned from the amount of land they owned. The age of respondents varied from 21 to 72 years, with most individuals in the 25-45-year category (44%; n=36) (Table 1). Efforts were made to interview equal number of men (n=42; 52% of respondents) and women (n=39; 48% of respondents). 40% (n=32) of the respondents had education till a primary-school level, and only 11% (n=9) had education to a college level. However, the number of illiterate individuals was low in our sample (3.7%; n=3). The average homestead or non-paddy farming land owned was 1.39 *bighas*, and the median land holding was 1 *bigha*.

Table 1: Descriptives of survey respondents

	n	Mean age (SD)	Mean years of education (SD)	Mean homestead land owned
Overall	81	41.12 (15.13)	8.13 (4.58)	1.39 <i>bighas</i> * (SD=1.35)
Men	42	46.69 (17.24)	8.50 (4.96)	
Women	39	35.54 (10.59)	7.73 (4.34)	

*1 *bigha* = 1338 m²



Fig. 1bc: Interviews and data collection in the field.

ANALYSIS

A series of non-parametric tests were conducted to examine differences in attitudes to macaques according to their spatial location (villages, temples, reserves), as well as differences in opinion as to who should manage macaques / mitigate conflict. The Friedman's non-parametric test for multiple related samples was selected as it is a useful alternative to a repeated measures analysis of variance, and is especially appropriate for small samples and ordinal test variables (Conover, 1980). The Friedman procedure tests the null hypothesis that multiple ordinal responses come from the same population. All statistics were done using SPSS (version 16).

RESULTS

What is the extent of human-macaque conflict in rural areas in Assam? How do communities perceive such conflict?

The study sites in Kaziranga and Komargaon (Fig. 1a) both had human-macaque conflict. Differences in the extent of crop-damage (Mann-Whitney $U= 52.00$; $p= 0.815$), stealing (Mann-Whitney $U= 56.00$, $p=1.00$), attack incidents (Mann-Whitney $U= 40.00$; $p= 0.102$), and being mauled (Mann-Whitney $U= 35.00$; $p= 0.165$) in the two regions were not significant. Hence the data from both sites were pooled and are discussed together. Of the 81 households that were surveyed, 77% ($n=63$) faced problems of crop damage and 82% ($n=66$) said that macaques frequently came into their houses to steal food (Fig.

2).

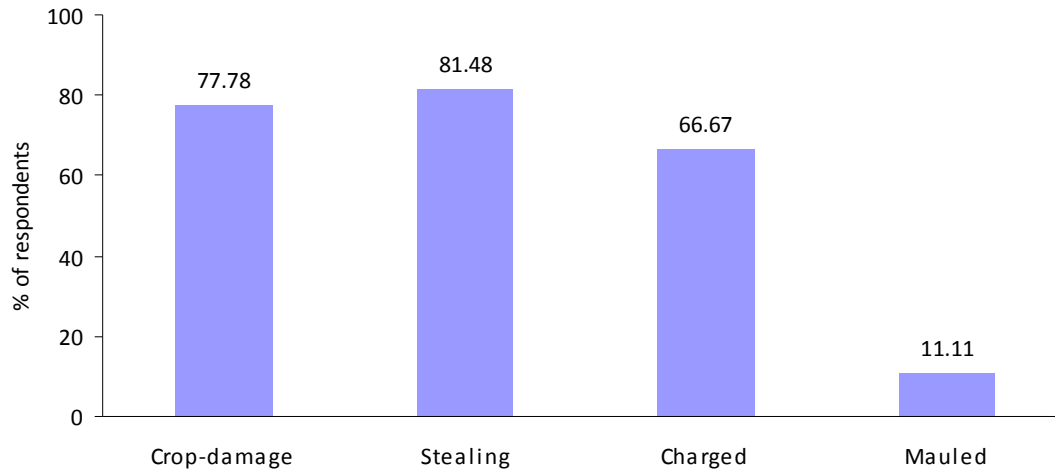


Fig. 2: Exposure to various aspects human-macaque conflict (n=81).

A total of 41 different vegetables and fruiting crops were grown in the area, most of which are winter crops (Table 2). Besides being a source of food for local people, a majority of these crops are sold in local markets and supplement household incomes. These crops were arbitrarily grouped into four categories depending upon the extent of damage: (1) high (>60%; n=7), (2) intermediate (40-59%; n=14), (3) moderate (10-39%; n=13) and (4) none or negligible damage (0-6%; n=7). Examples of the ‘highly raided’ category include papaya, pineapple, potato, pumpkin and banana. ‘Intermediately raided’ crops included jackfruit, aubergine, cucumber and coriander, whilst ‘moderately raided’ crops include carrots, radish, spinach and bitter gourd. Betel nut and chilli were the two least affected crops (not damaged at all), followed by turmeric, coconut and ginger (1-2% damaged annually). The high levels of perceived damage by macaques potentially influence peoples’ attitudes to macaques and their willingness to conserve them.

Table 2: Crops raided by macaques. Mean score (on a scale of ten) indicates amount perceived to be damaged by macaques. Only crops present on >5 farms are listed. (n=81)

	Crop		Mean Score	SD	No. of farms present	Market Value (Rs) / unit
High	Papaya	<i>Carica papaya</i>	8.00	2.45	72	8.00 / kg
	Pineapple	<i>Ananas comosus</i>	7.67	2.52	9	15.00-20.00 / fruit
	Mustard	<i>Brassica nigra</i>	7.40	1.82	15	60.00 / kg
	Potato	<i>Solanum tuberosum</i>	7.14	3.39	42	14.00 / kg
	Pumpkin	<i>Cucurbita moschata</i>	7.00	3.13	57	35.00-40.00 / fruit
	Bottle Gourd	<i>Lagenaria siceraria</i>	6.50	3.29	66	15.00-20.00 / fruit
	Banana	<i>Musa splendida</i>	6.36	2.77	66	2.00 / fruit
Intermediate	Ridged Luffa	<i>Luffa acutangula</i>	5.89	2.83	54	15.00-18.00 / kg
	Yardlong bean	<i>Vigna unguiculata</i>	5.78	3.70	54	30.00 / kg
	Cauliflower	<i>Brassica oleracea</i> Botrytis group	5.56	3.78	27	8.00 / kg
	Cucumber	<i>Cucumis sativus</i>	5.53	3.60	45	15.00 / kg
	Mango	<i>Mangifera indica</i>	5.52	3.63	63	6.00 / kg
	Sugarcane	<i>Saccharum officinarum</i>	5.36	3.50	33	3.5 / kg
	Kohlrabi	<i>Brassica oleracea</i> Gongyloides group	5.33	3.67	27	10.00 / kg
	Eggplant	<i>Solanum melongena</i>	5.25	3.15	48	15.00-20.00 / kg
	Guava	<i>Psidium guajava</i>	5.14	3.13	42	10.00-12.00 / kg
	Tomato	<i>Solanum lycopersicum</i>	4.82	3.40	51	30.00 / kg
	Coriander	<i>Coriandrum sativum</i>	4.50	4.36	54	2.00 / bunch
	Jujube	<i>Zizyphus jujube</i>	4.38	3.52	39	7.00 / kg
	Jackfruit	<i>Artocarpus heterophyllus</i>	4.38	3.64	39	20.00 / fruit
	Siral		4.00	3.12	27	20.00 / fruit
Moderate	Bamboo shoot	<i>Dendrocalamus</i> spp	3.95	2.57	57	5.00 / kg
	Carrot	<i>Daucus carota</i>	3.88	3.94	24	20.00-40.00 / kg
	Cabbage	<i>Brassica oleracea</i> Capitata group	3.56	3.84	27	8.00-20.00 / kg
	Pomelo	<i>Citrus maxima</i>	3.30	3.56	30	10.00 / fruit
	Radish	<i>Raphanus sativus</i>	3.12	2.89	51	15.00 / kg
	White gourd	<i>Benincasa hispida</i>	2.55	2.24	66	10.00-25.00 / fruit
	Rice	<i>Oryza sativa</i>	2.46	2.54	39	21.00 / kg
	Yam	<i>Dioscorea alata</i>	2.00	1.73	9	10.00-18.00 / kg
	Mustard greens	<i>Brassica juncea</i>	1.95	2.44	63	2.00 / bunch
	Okra	<i>Abelmoschus esculentus</i>	1.53	2.23	45	45.00 / kg
	Bitter gourd	<i>Momordica charantia</i>	1.42	2.39	36	45.00 / kg
	Spinach	<i>Spinacia oleracea</i>	1.35	2.03	60	5.00 / bunch
	Teasle gourd	<i>Momordica dioica</i>	1.12	2.42	51	15.00 / kg
Negligible / None	Arum	<i>Alocasia indica</i>	0.62	2.22	39	18.00 / kg
	Lemon	<i>Citrus limon</i>	0.50	1.00	12	3.00 / fruit
	Ginger	<i>Zingiber officinale</i>	0.25	0.58	48	60.00-80.00 / kg
	Coconut	<i>Cocos nucifera</i>	0.13	0.52	45	15.00-25.00 / fruit
	Turmeric	<i>Curcuma longa</i>	0.10	0.45	60	60.00 / kg
	Betel nut	<i>Areca catechu</i>	0.00	0.00	9	0.60 / fruit
	Chili	<i>Capsicum frutescens</i>	0.00	0.00	66	70.00 / kg

There was no relationship between the extent of crops damaged and the number of farms growing the crop ($r^2= 0.052$; $\beta= -0.228$; $p=0.115$), suggesting that people had not taken any serious precautions to alter growing crops that macaques favoured. When asked “To what extent have you reduced cultivating crops because of macaque activities?” replies ranged from “no reduction” (25% of respondents) to 90% (7% of respondents) (Fig. 3). 25% of the respondents said they had reduced cultivation by 5-40%, and another 25% said they had reduced cultivation “by half”. The latter is likely to be an artefact of guess estimates. Overall, 75% of the respondents did say they had reduced some amount of cultivation because of macaques suggesting that macaques were an issue locally.

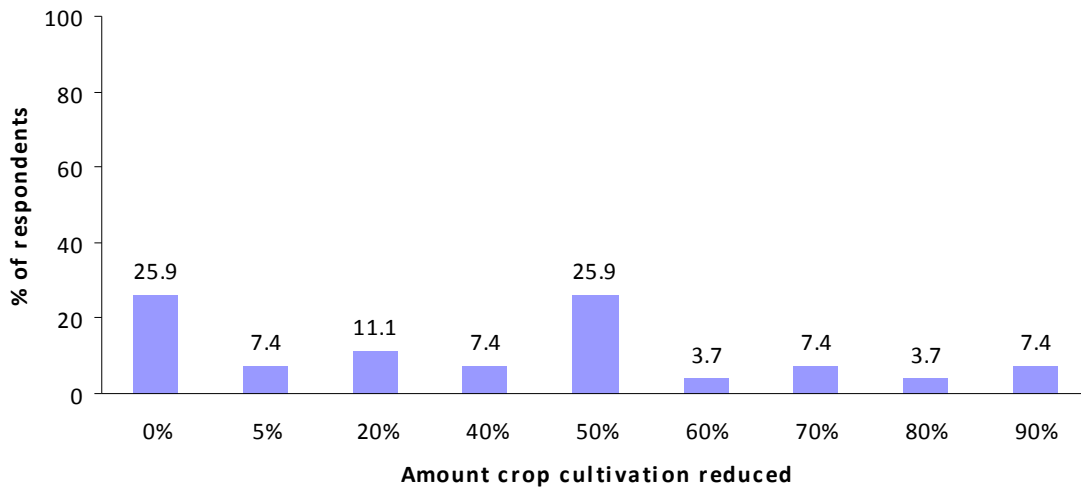


Fig. 3: Reduction in the amount of cash / garden crops grown as a result of macaque activities (n=81).

On average, macaques raided houses / farms 2-3 times a week (Table 3), coinciding with movements of the free-ranging macaque troupes across a village landscape. In some cases, this was up to 4 or 5 times in the week, depending upon the food sources available at the time of year. When in the vicinity, macaques made forays into the same house 3-5 times a day depending upon the presence of guardians or householders. Although on average 10-15 macaques entered homegardens, peoples’ estimates of the number of raiding macaques were exaggerated. In some cases, respondents said troupes of “150 to 200” macaques come to raid crops. No specific time of raiding by macaques was observed, and this is reflected in the most frequent response that “there is no specific

time” of day when macaques enter gardens or houses. A majority of people (74%; n=60) said macaques were in their vicinity all year round, and this coincides with the fact that the macaque troupes were more or less resident in the peri-urban / homegarden matrix. Some respondents also said that the winter months were particularly bad, as this coincides with the vegetable-growing season when there is plenty of food for macaques in peoples’ gardens.

Most people said they had to be alert “24 hours” whenever macaques were in their vicinity (Table. 3), and on average spent 3-4 hours a week chasing them. Such extensive guarding indicates that people spend considerable amount of time keeping their crops / food safe from raiding macaques. There was a difference in the amount of time macaques spent in a person’s farm when people were absent, and when people were present. As these were guess estimates rather than actual measures, differences were not tested statistically (see Table 3). However differences, if computed, are likely to be significant.

Table 3: Extent of conflict and time spent in guarding homes / farms from macaques (n=81).

Question	Most frequent response
Number of raids per day by macaques?	“3 to 5 times” (26%; n=21)
Number of raids per week by macaques?	“2 to 3 times” (15%; n=12)
Number of raiding macaques?	Ranging from “2 to 3” to “150 to 200”. Most estimates were between 10 and 30.
What time of day do macaques raid farms / houses?	“No specific time, they come at all times” (63%; n=51)
Which months of the year do macaques raid farms / houses?	“All year round” (74%; n=60)
How much time do you spend every week guarding crops from macaques?	“24 hours”, indicating that they had to be alert all the time (78%; n=63)
How much time do you every week spend chasing macaques?	“3 to 4 hours” (22%; n=18)
How much time do macaques spend in your farm when people are absent?	“All day” (55%; n=45)
How much time do macaques spend in your farm when people are present?	“10 to 15 minutes” (33%; n=27)

Sixty-seven percent of the respondents said they had been charged by macaques at some point (Fig. 2). This generally involved display of aggressive behaviour by large males, and women often complained that these macaques were “completely unafraid” and “difficult to chase if men were not present”. Eleven percent said they had been mauled or

bitten by macaques, but most of these incidents happened by chance rather than deliberate attacks. Differences between attacks on men and women were not statistically significant. However, several respondents said that women were more vulnerable to attacks than men, partly because male macaques were less afraid of women. In fact, 78% of the respondents (n=63) said that overall, women were more affected by human-macaque conflict than men (Fig. 4).

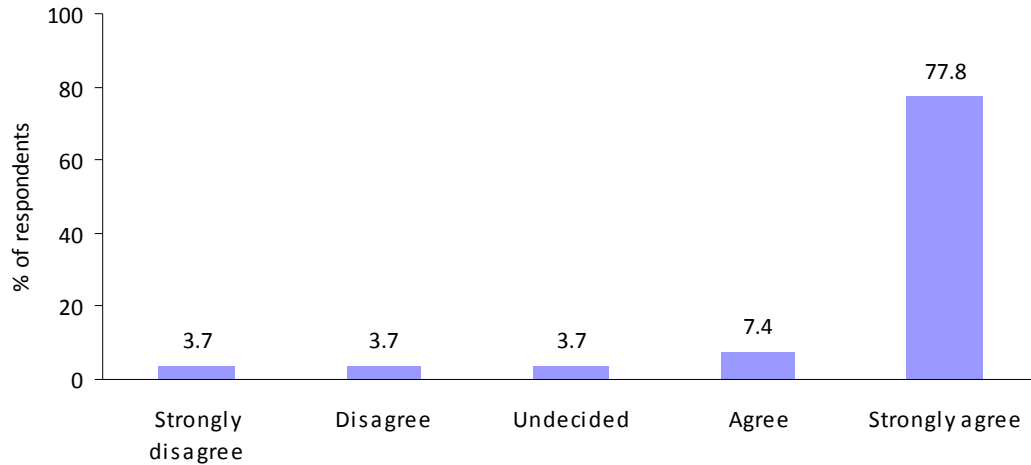


Fig. 4: Responses to the question “Are women more affected by macaques than men?” (n=81).

Overall, most respondents (59.3%) thought the issue of human-macaque conflict was a “very serious” problem (Fig. 5). On the other hand, twenty-two percent labelled the issue as “serious”, whilst 7% thought it was a “moderate” problem. Another 7% said human-macaque conflict was a “minor problem” and only 4% said there was no real issue.

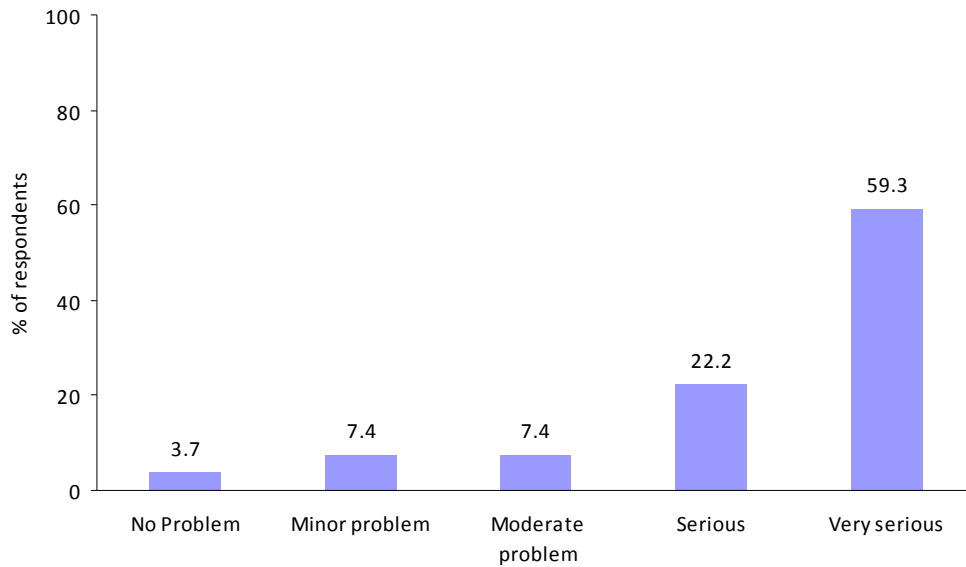


Fig. 5: Responses to the question: “How bad is the problem of human-macaque conflict?” (n=81).

What cultural values and attitudes towards macaques do people uphold, and to what extent is it undermined by human-macaque conflict?

Three statements examining cultural values of macaques were asked: (1) “Macaques have religious attributes”, (2) “Macaques are disciples of Lord Rām” and (3) “Macaques are companions of Hanumān”. Forty-four percent (n=36) said macaques still have religious attributes, whilst 40% (n=32) said they had them in the past but not any more, and 7% (n=6) said they never had any religious attributes (Fig. 6). The number of people who thought they were disciples of Lord Rām was slightly higher (52%; n=42). Thirty-three percent (n=27) thought they were disciples of Rām in the past, but not anymore and 11% (n=9) said “these macaques” never were disciples. Similarly, 56% (n=45) said they were companions of the monkey-god Hanumān and 26% (n=21) thought they were companions in the past but not anymore. The number of respondents who felt macaques no longer have or never had religious attributes was ~50% in all cases, suggesting that cultural values have potentially been eroded or are undermined by human-macaque conflict.

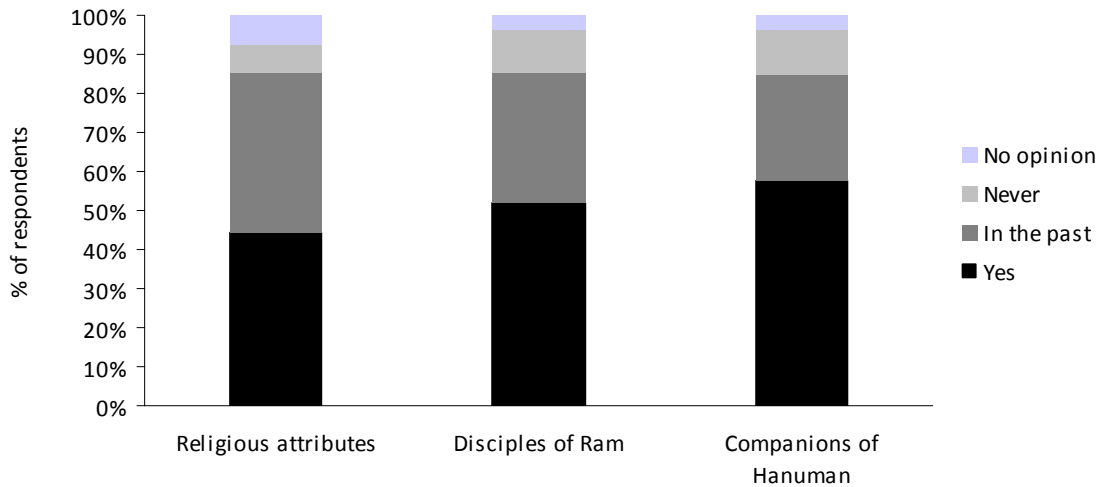


Fig. 6: Responses to the statements (1) “Macaques have religious attributes”, (2) “Macaques are disciples of Lord Rām”, and (3) “Macaques are companions of Hanumān” (n=81).

Respondents were also asked to rank four positively-worded statements [(1) “Macaques are likable”, (2) “Macaques have a right to live in our environment”, (3) “Macaques are a pleasure to live with” and (4) “Macaques are important and we need to conserve them”] and one negatively-worded statement (“Assam is better of without macaques”) on a 5-point Likert scale. Overall, people did think macaques fairly likable (mean=3.92; SD=1.41) and did not think Assam would be better of without macaques (mean=2.19; SD=1.77) (Fig. 7). There was a fair amount of ambiguity as to whether macaques should be conserved (mean=3.11; SD=1.74) and about their rights to live in human environments (mean=2.81; SD=1.88). However, people did not think macaques were a pleasure to live with (mean=2.07; SD=1.57).

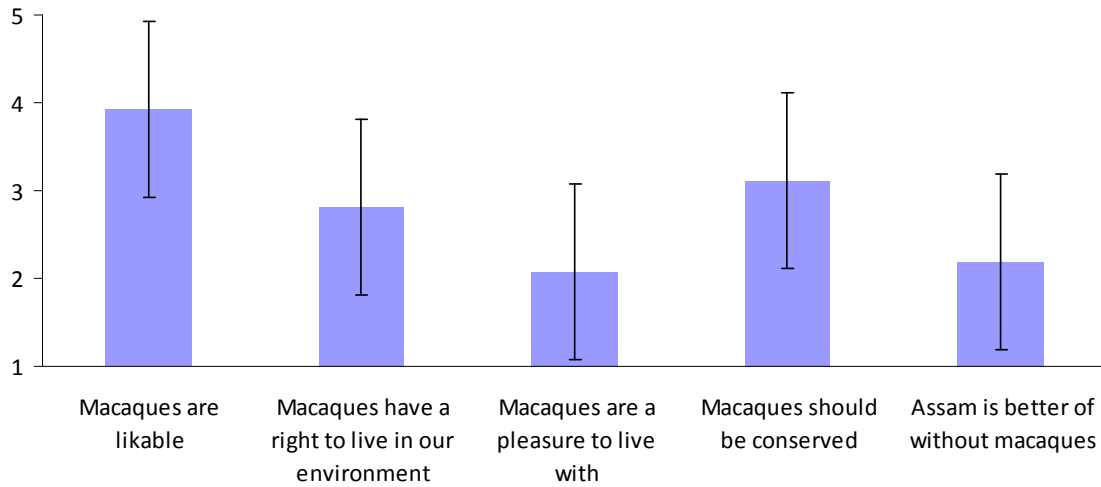


Fig. 7: Responses to statements examining peoples' attitudes to macaques (n=81).

This attitude is also reflected in the responses to the question “Where should macaques live?” (Fig. 8). Urban areas (mean=1.33; SD=0.96) and villages (mean=1.26; SD=0.94) were the least favoured localities. People were ambiguous about whether macaques should live in temples (mean=2.78; SD=1.65). Reserves, i.e. protected areas or wildlife sanctuaries, were what most people thought was the most appropriate space for macaques (mean=4.85; SD=0.36). The spatial context played an important role in structuring peoples' attitudes towards macaques. For instance, more people thought that macaques in temples were disciples of Lord Rām than village macaques or macaques in reserves (Table 4). However, responses as to whether macaques were companions of Hanumān did not show influence of spatial contexts. Similarly, people liked macaques in reserves and temples more than they liked macaques in villages (Table 5). Views on as to where macaques should live were significantly different between urban areas, village spaces, temples and reserves.



Fig. 8: Responses to the question "Where should macaques live?" (n=81).

Table 4: Do cultural values vary for macaques in different localities?

Statement		Yes	In the past	Never	Mean Rank	Sig. ¹
Religious attributes	Village macaques	39.3%	28.6%	14.3%	2.19	0.069
	Temple macaques	32.1%	14.3%	28.6%	1.90	
	Reserve macaques	32.1%	14.3%	28.6%	1.90	
Disciples of Rām	Village macaques	33.3%	22.2%	29.6%	1.89	0.039*
	Temple macaques	44.4%	25.9%	14.8%	2.15	
	Reserve macaques	37.0%	22.2%	25.9%	1.96	
Companions of Hanumān	Village macaques	44.4%	18.5%	22.2%	1.95	0.135
	Temple macaques	48.1%	22.2%	11.1%	2.09	
	Reserve macaques	48.1%	18.5%	18.5%	1.95	

¹Friedman Test; * $p < 0.05$

Table 5: Do attitudes vary for macaques in different localities?

Statement		Mean Rank	Sig. ¹
Macaques are likable	Village macaques	1.74	0.012*
	Temple macaques	2.10	
	Reserve macaques	2.16	
Macaques should live in...	Urban areas	1.83	0.000***
	Villages	1.78	
	Temples	2.56	
	Reserves	3.83	

¹Friedman Test; * $p < 0.05$; *** $p < 0.001$

What conflict mitigation strategies have been deployed by people? What solutions to human-macaque conflict are culturally acceptable and logistically feasible?

Several protection measures were deployed by people to reduce crop damage / stealing by macaques (Fig. 9). Guarding (93%; n=75) and the use of slingshots / bow and arrows or stones (89%; n=72) were the two most frequently used strategies, followed by the erection of fences or barriers (50%; n=41) and the use of local dogs (41%; n=33). A few individuals (11%; n=9) said they had tried using chemical deterrents / poison, but they were not effective. A group of villagers also trapped macaques and relocated them to a nearby temple on one occasion, but apparently “the macaques came back after a few days”. Individuals who said they shot at macaques was relatively low (4%; n=3), but this figure may reflect a response desirability bias rather than an actual number. The use of slingshots was considered to be the most effective strategy for preventing macaques from entering homegardens or peoples’ compound (58% ‘high effectiveness’, 33% ‘medium’ and 8% ‘low’) (Fig. 10). Although guarding was the most frequently used strategy, only 32% (n=26) thought it had good effect. Fences / barriers were not considered effective by most respondents (71% ‘low effectiveness’) and neither was the use of dogs (73% ‘low effectiveness’).

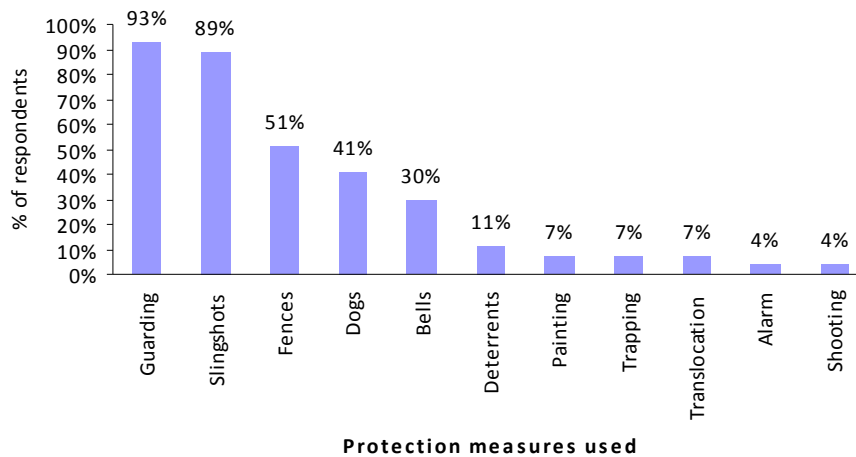


Fig. 9: Protection measures used by people to prevent macaques from entering their homes or raiding crops (n=81).

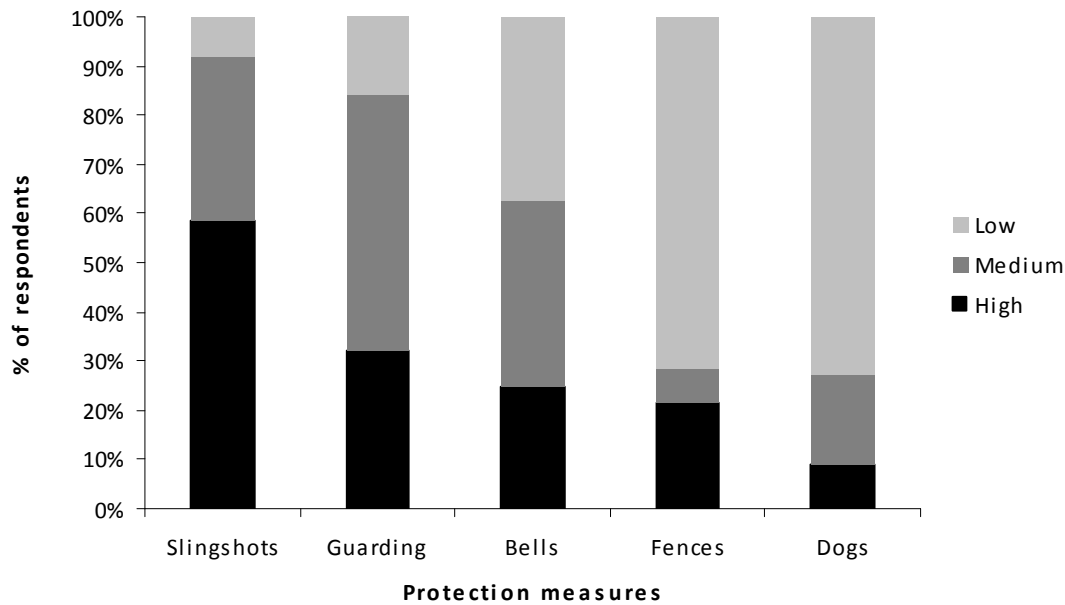


Fig. 10: Perceived effectiveness of frequently-used protection measures. (n=81).

A range of solutions to human-macaque conflict were proposed by people (Fig. 11). Respondents were ambiguous as to whether macaque populations should be protected by law (mean=3.32; SD=1.84) and did not think killing macaques was an acceptable option (mean=1.96; SD=1.60). Controlling macaque populations (mean=3.67; SD=1.73) was a more favoured opinion, but individuals were uncertain as to how this should be done. Relocating macaques was something that people thought would be an effective solution, and overall scores for this variable was much higher than the others (mean=4.31; SD=1.46). Further, there were significant differences in opinion as to which macaques should be protected by law. Village macaques ranked much lower than macaques in temples or in reserves (Table 6). Similarly, rankings for controlling macaque populations were significantly higher for village macaques than temple or reserve animals. This trend was also reflected in the case of relocations: people felt that village macaques were the ones in need of relocation as opposed to ones in temples or reserves.

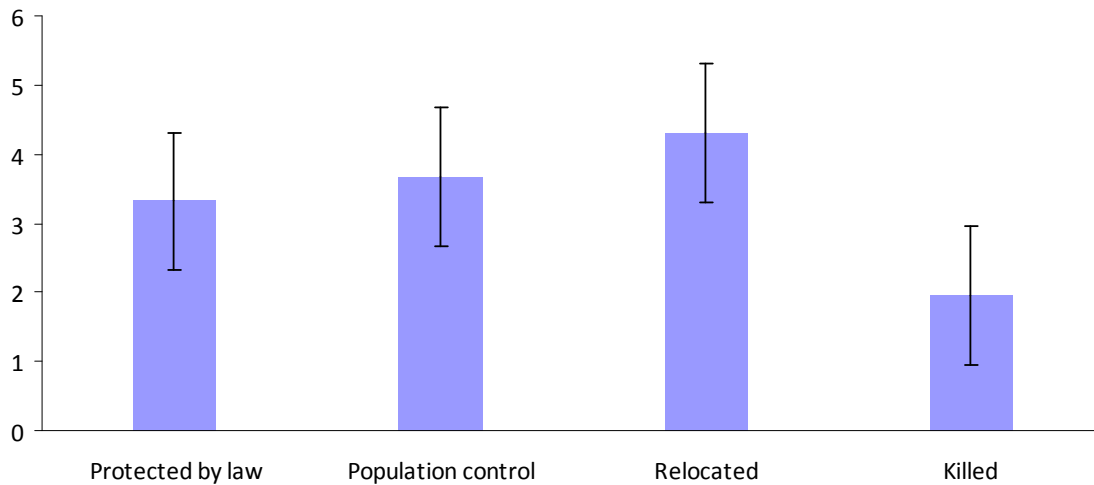


Fig. 11: Responses to the statements: (1) “Macaques should be protected by law”, (2) “Populations of macaques should be controlled”, (2) “Macaques should be relocated”, and (3) “Macaques should be killed”. (n=81).

Table 6: Do desired mitigation / conservation strategies vary for macaques in different localities? (n=81)

Statement		Mean Rank	Sig. ¹
Macaques should be protected by law	Village macaques	1.79	0.042*
	Temple macaques	2.03	
	Reserve macaques	2.18	
Populations of macaques should be controlled	Village macaques	2.50	0.001**
	Temple macaques	1.80	
	Reserve macaques	1.70	
Macaques should be killed	Village macaques	2.25	0.223
	Temple macaques	2.00	
	Reserve macaques	1.75	
Macaques should be relocated	Village macaques	2.43	0.037*
	Temple macaques	2.07	
	Reserve macaques	1.50	

¹Friedman Test; * $p < 0.05$; ** $p < 0.01$

Reserves were considered to be the most appropriate place to relocate macaque populations (mean=4.12; SD=1.62) (Fig. 12). Although zoos were not an obvious suggestion by villagers, when asked, respondents agreed that it would be a suitable location to relocate macaques (mean=3.46; SD=1.67). Temples scored low (mean=2.30; SD=1.69) as a place for relocation, and people felt that taking macaques to other villages where there were no extant populations was not a good idea as others were likely to suffer. Differences as to which localities macaques should be relocated to were also significant (Table 7).



Fig. 12: Places where people felt macaques should be relocated. (n=81).

Table 7: Where should macaques be relocated?

Statement		Mean Rank	Sig. ¹
Macaques should be relocated to	Reserves	3.41	0.000***
	Temples	2.15	
	Other villages	1.57	
	Zoos	1.87	

¹Friedman Test; *** $p < 0.001$

There were differences as to who should manage macaque populations in temples and villages (Fig.13; Table 8). People felt that the onus was largely on the forest department to manage macaque populations in villages (mean=4.27; SD=1.46), and on temple management committees for macaques in temples (mean=3.65; SD=1.82). The local community was not willing to take direct responsibility for managing macaque populations in villages (mean=2.92; SD=1.85) and less so in temples (mean=2.61; SD=1.90). People also felt that NGOs did not have a major role to play in management (village macaques mean=2.92, SD=1.69; temple macaques mean=2.43, SD=1.85). Respondents also said that the forest department should do the relocations (Table 8).

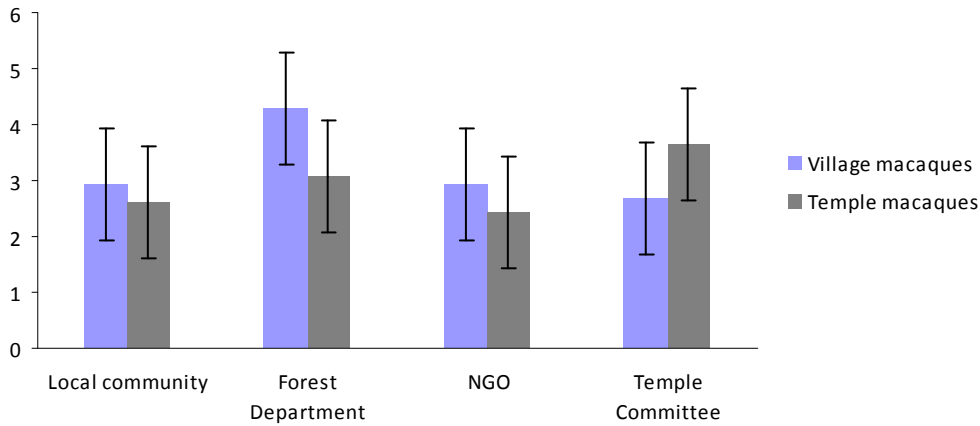


Fig. 13: Responses to the statements: (1) “Village macaques should be managed by...”, and (2) “Temple macaques should be managed by...”. (n=81).

Table 8: Who should manage macaque populations in different localities? (n=81).

Statement		Mean Rank	Sig. ¹
Village macaques should be managed by	Local community	2.45	0.004**
	Forest department	3.14	
	NGO	2.29	
	Temple committee	2.12	
Temple macaques should be managed by	Local community	2.31	0.041*
	Forest department	2.57	
	NGO	2.19	
	Temple committee	2.93	
Relocation should be done by	Local community	1.92	0.000***
	Forest department	3.60	
	NGO	2.38	
	Temple committee	2.10	

¹Friedman Test; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$

Fifty-two percent of the respondents (n=42) said they were willing to tolerate macaques in their vicinity if they damaged not more than 5-20% of their crops (Fig. 14). The extent of damage people were willing to tolerate was overall not more than 50%, and the number of individuals who quoted this high figure was low (7%; n=6). A large number of people (22%; n=18) said they were not willing to tolerate any amount of crop damage by macaques. Overall the data showed a negative trend with an increase in the extent of damage (trend $r^2=0.582$). People were ambiguous about spending money for macaque conservation (mean=3.00; SD=1.79) and plant alternative crops that macaques rarely fed on (mean=3.32; SD=1.75) (Fig. 15). Willingness to pay for macaque relocation was

higher than the preceding variables (mean=3.69; SD=1.59), but this was lower than what would have been expected. Respondents were most willing to pay for a village-based protection scheme (mean=4.42; SD=0.90)

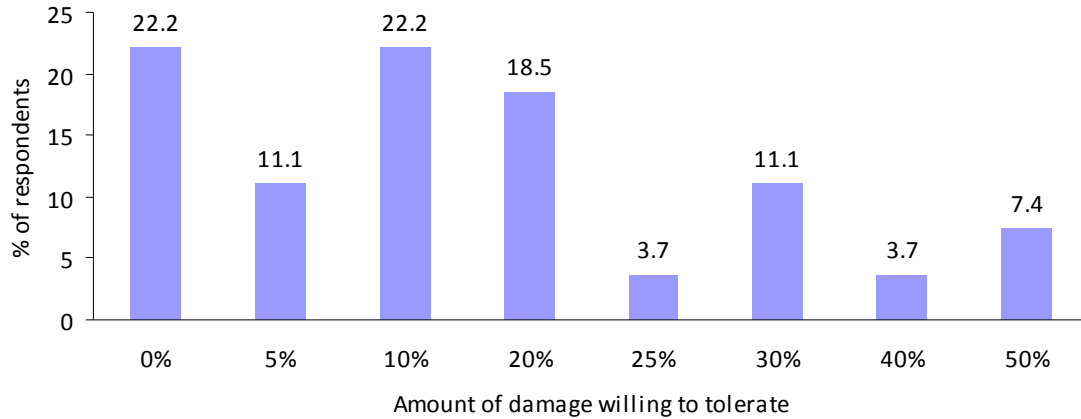


Fig. 14: Amount of crop damage by macaques that people were willing to tolerate (n=81).

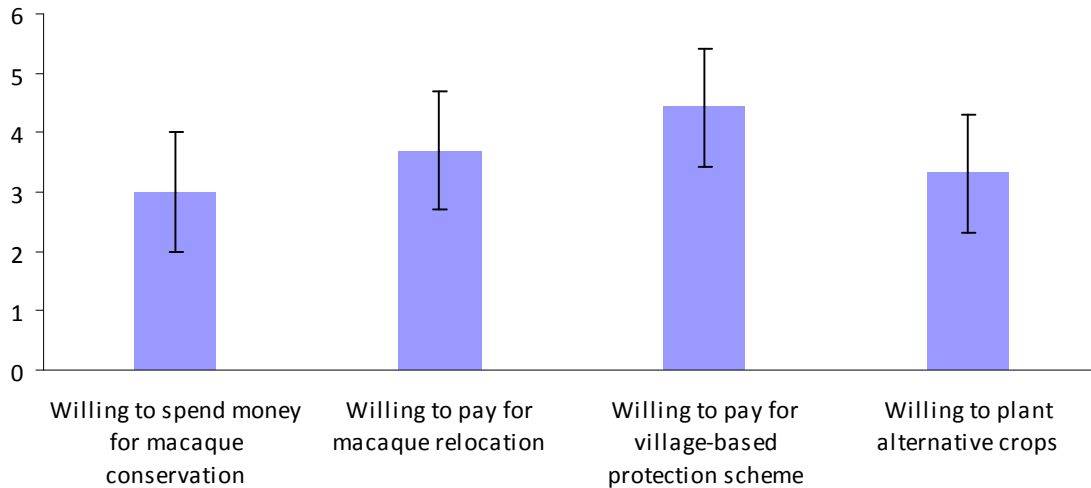


Fig. 15: People were most willing to invest in a village-based protection scheme (n=81).

Compensation for crop damage by macaques was an option that people agreed to, but scores for this variable were only just above mid-range (mean=3.81; SD=1.55) (Fig. 16). Respondents felt that funds for compensation should be provided by the Forest Department (mean=4.38; SD=1.02). Initiating a village fund (mean=3.50; SD=1.97) or

compensation through NGOs (mean=3.60; SD=1.52) generated less positive responses. Compensation through temple committees was not favoured (mean=2.33; SD=2.31).

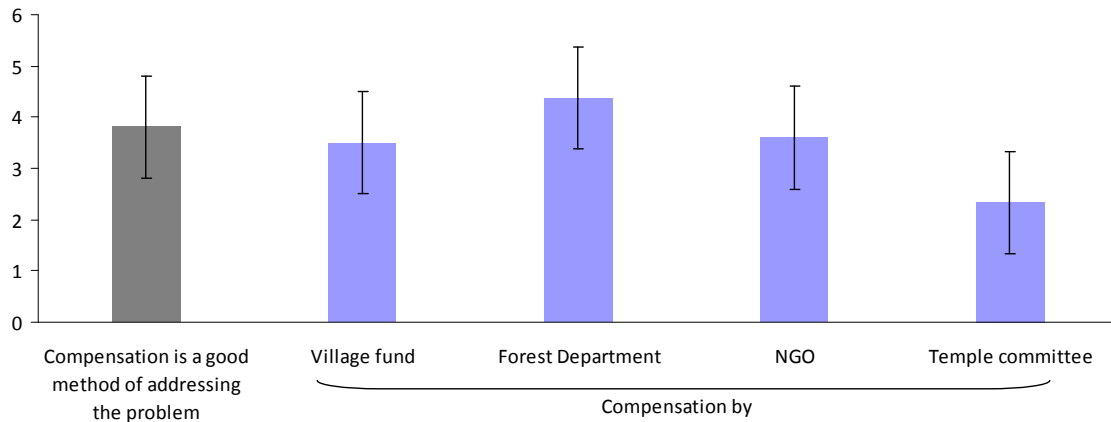


Fig. 16: Attitudes to compensation and organizations that should conduct the process (n=81).

DISCUSSION

Extent and perceptions of human-macaque conflict

The results of this study support erstwhile observations that human-macaque conflict is a serious issue in rural areas of Assam (Medhi et al. 2007). This is especially true in villages where macaques live all year round, and where there is little neighbouring forest cover for them to forage. In the four study villages, crop-damage and stealing from houses were rampant, and there were a few occasions where individuals were mauled. More than 90% of the subsistence / cash crop species grown in these localities were fed upon by macaques. As some respondents put it:

“What won’t monkeys eat? In Assamese, there is a saying that monkeys don’t understand the value of coconuts. But not anymore... nowadays these monkeys even steal coconuts. [sic]”

“Earlier the macaques in our village were shy. And they would not feed on all crops, for instance pumpkin... but nowadays you can barely manage to eat any pumpkins yourself...”

Seventy-five percent of the respondents said they had reduced some amount of cultivation as a result of macaque activities, the figure generally varying from 5 to 50%.

Although 25% said that “half” their crops were damaged or raided, only 7% were willing to tolerate this extent of damage. Such responses are likely in a rural agricultural context, as several households are dependent on vegetable / cash crops as a supplement to their annual income.

The presence of free-ranging macaque troupes in villages resulted in frequent forays into houses or gardens, and the situation was more intense during the winter months when people grew fruits or vegetables. It was not just the extent of damage that annoyed people, but also the manner in which the damage was done:

“Macaques waste a lot of food. When they can’t find anything to eat in the fields, they destroy whatever is there ...”

People believed that there was a loss of foraging areas in and around villages, as a result of which crop-raiding by macaques had increased. Most people said they had to be alert “24 hours”, suggesting that the presence of people was necessary to protect crops or food. As one lady put it:

“When monkeys come, we have to pluck the vegetables and bring them inside so that they won’t get them”

The need for people to be present in the house has congealed social costs over and above the tangible damage caused by macaques (Ogra, 2008). The questionnaire responses showed that a large proportion of people thought women were more affected by conflict. Men are often not present during the day and women disproportionately bear the burden of guarding the house or garden. There was a general belief in the villages that large male macaques were less afraid of women and were more aggressive towards them:

“One on occasion, a large macaque waited for the man and children to leave the house, and then came in and slapped the woman”

“These macaques are not at all afraid of women... in fact sometimes even steal their clothes! They attack if women go out to chase them”

A lady that we interviewed also said that forays by macaques had led to domestic violence as her husband got irritated when vegetables were destroyed. Slingshots were viewed to be the most effective protective measure against macaques, but later interviews revealed that very few women knew how to use them. This potentially contributes to the manner in which human-macaque conflict differently affects men and women.

Cultural values, attitudes and human-macaque conflict

Although cultural values of primates are believed to work in favour of their conservation status in India (Medhi et al. 2007), this study shows that many of these values may be eroded when there is conflict. For instance, a large number of people felt that macaques only had religious attributes in the past but not any more. As some respondents put it:

“Neither is there any Rām nor is there Ayodhya.¹ If they were disciples of Rām, in no way would they raid our crops or steal food from houses in this manner”

“These macaques are in no way disciples of Rām”

However, a greater number of respondents said macaques were companions of the monkey-god Hanumān. This may be because a lot of people still believe primates are incarnations of Hanumān, beliefs that are sometimes reinforced through sentient experiences:

“A man named Atul once killed a macaque with an axe ten or twelve years ago. The poor creature clasped his hands together as it lay dying... It was a terrible sight, but you then realize that there is something in them... they are Hanumān ... [sic.]”

“A person in our village shot a macaque once. The wounded animal drew its hands together so as to do a namaskar.² It is also a sentient creature, and has emotions... Macaques also have some influence of god”

Such narratives anthropomorphizing macaques were quite common:

“Monkey means human. ... Killing a monkey is a sin equivalent to killing a human”

The phenotypic similarity (and taxonomic proximity) between humans and macaques works in favour of macaques and potentially prevents the promotion of culling as a solution to the conflict:

“There are so many things that monkeys do which are like humans and that is great to watch. It is only when they cause trouble that they are annoying.”

Peoples' admiration of several macaque characteristics have been reported elsewhere,

¹ Ayodhya is considered to be Lord Rām's birthplace by many Hindus. Rights to building a temple there has been the subject of a major national political controversy, but in this instance the individual was metaphorically referring to loss and not the political issue.

² Reverential salute frequently used by Hindus and Jains in south Asia.

and in many instances although individuals culling monkeys may claim to be removing problem animals, they risk appearing to others as a killer of lovable animals (Knight, 2003). However, some individuals did say that certain youth would be happy to get rid of the macaques:

“Only the law is preventing them from killing these macaques. ... People are more afraid of the law than of god”

This potentially explains the ambiguous scores for the statements “Macaques should be conserved” and “Macaques should be protected by law”. Rhesus macaques are listed under Schedule II of the Indian (Wildlife) Protection Act, 1972 which prevents individuals from engaging in retributive killing of animals. Further, people believed that greater conservation activity would enforce stronger regulations and that they would not even be allowed to chase macaques with slingshots.

The spatial context played an important role in structuring peoples’ attitudes towards macaques. More people thought that macaques in temples were disciples of Lord Rām than village macaques or macaques in reserves. The temple context potentially endows religious attributes upon macaques, and feeding monkeys in temples is a practice prevalent amongst many people. Similarly, people liked macaques in reserves and temples more than they liked macaques in villages. This may be due to the fact that people believed macaques in temples or reserves remained there and did not come to damage crops in villages. Such spatial differentiation also had a strong influence on the conservation policies that people favoured. For instance, fewer people felt that village macaques should be protected by law, although they were comfortable with temple animals or ones in reserves being afforded protection. Overall, reserves were where people felt macaques should live:

“We wonder what is more important: humans or macaques? The government should take an initiative to conserve macaques elsewhere. They should find a reserve for macaques like the Kaziranga sanctuary for rhinos”

“The government should create a sanctuary for macaques... plant fruit trees so that they have enough to feed on, and don’t come into villages”

Mitigation strategies and acceptance of solutions

A wide range of protection measures were used by people to protect their gardens or homes from macaques. Guarding was the most frequent strategy, and differences in the time spent by macaques in gardens / farms when people were present were much lower than when they were absent. However, people felt that guarding was a taxing method as it meant that someone had to be present all the time, and this affected their day-to-day lives. One village had initiated a ‘macaque guarding troupe’ but this wasn’t effective:

“Where will they go? All we are doing is chase the macaques from one part of the village to another”

“Where will these animals go? Even if you chase them far away, they disappear for a few days only to come back again. ... People have given up this idea of cooperative efforts to chase macaques... Now the onus is on individual people to sort out the problem”

Moreover, many individuals said that a man had to be present if such guarding was to be effective. Several households had barricaded their windows and ventilators to prevent macaques from entering. Whilst this prevented entry into the house, barriers were largely ineffective in keeping macaques out of farms or vegetable gardens.

Controlling the growth of macaque populations was an option that the villagers thought would be a good way of reducing the magnitude of the problem. However, individuals were uncertain as to how this could be done and didn’t see the government or forest department taking any foreseeable steps in this direction. Relocating macaques to forest reserves was what people favoured as a mitigation strategy and strongly believed that macaques in their villages should be relocated elsewhere. In fact, one village had taken a decision to trap macaques and release them in a temple about 15 km away. The effort, however, was unsuccessful:

“There are about 40 macaques in our village, and we managed to capture 18-20 animals. When we released them in Baba Than the animals came back after a few weeks. There was probably infighting between these macaques and those already present in the temple.”

“Macaques won’t be allowed to stay in other places as there are different troupes present there. The local macaques of that area will chase them out. Relocation

won't work unless they are taken to some "foreign" land

People felt that the onus was largely on the forest department to manage macaque populations in villages and to relocate them to forest reserves elsewhere. Whilst respondents said they were willing to contribute money towards relocating macaques, the support for such schemes was not as high as might be expected. This might stem from the failure of earlier village-based relocation efforts, as well as from anxieties over the quasi-legal nature of the intervention:

"People are reluctant to get involved in such exercises as it was done with the government's permission. We complained to the government many times, but they didn't take any action. However, you never know when someone is going to sneak on you..."

There was a lack of personal responsibility in contributing to macaque conservation or to plant alternative crops that are unpalatable for macaques. Compensation for crop damage might be a potential solution, but several individuals expressed their reservations for such schemes:

"Compensating for damage allows the government to take a hands-off approach. They won't be doing anything about the real problem... and we all know how government schemes work..."

"The idea of compensation is not bad, but the government will only compensate us once. Depredation by macaques is a recurrent problem. It is not a long-term solution"

"Macaques are always present in our village. How much will you compensate? Instead, what we need are vaccines from monkey attacks"

Respondents felt that funds for compensation, if at all, should be provided by the forest department. The initiation of a village fund or compensation through NGOs elicited less positive responses, potentially because it would mean greater self-organization and mobilization. Moreover, compensation through temple committees was not favoured as people believed that temple macaques do not come into villages and that temple money should be used for religious purposes.

CONCLUSIONS

Human-macaque conflict is a major issue in villages that affects peoples' day to day lives. Although research on human-macaque conflict in India has received scant academic attention, the magnitude of the problem may be on the same scale as that of large carnivores or elephants. This partly stems from the low conservation priority of the Rhesus macaque and also because it is not as charismatic a species as the tiger or Asian elephant. However, as this study indicates, peoples' daily lives and income are affected by macaques in rural areas. With macaque troupes being resident in the village / agricultural matrix, conflict is prolonged and takes place all year round. Depletion of available food sources and disappearance of foraging areas in villages has further aggravated the problem. In the study area, small patches of village woodland and homegardens were continually being urbanized or converted to small-holder tea estates and if this trend continues, it is likely to escalate conflict in the future.

Whilst mythological beliefs surrounding primates are known to impose cultural rules forbidding the harming or killing of these animals (Fargey, 1992; Knight, 1999), the degree of conflict and the *manner* in which such damage is caused negatively impacts upon peoples' cultural values and perceptions of macaques. Such trends have also been observed in other species that come into conflict with humans, e.g. the Asian elephant (Barua et al. *in press*). In the study villages, a reduction in peoples' tolerance and an erosion of cultural beliefs was evident. This challenges notions that people are likely to conserve macaques on the basis of cultural values or beliefs that they uphold (Medhi et al. 2007). Although awareness programmes have been suggested as potential ways of mitigating conflict, such interventions need to assess on-ground situations rather than resorting to culture as a panacea. In the local community studied here, phenotypic similarity between humans and macaques combined with a fear of the law potentially prevented retributive killing. However, an overall unwillingness to co-inhabit space with macaques was eminent.

The lack of clear-cut local solutions and the general unwillingness of communities to take part in macaque conservation have multiple roots. They partly stem from poor institutional governance in wildlife management, especially in non-reserve areas where the jurisdiction of the forest department ends. Although the management of all wildlife

in India falls under the responsibility of the forest department, their authority does not extend to civil areas. There is thus a need for intra-governmental collaboration and cooperation (especially with civil authorities) whilst intervening in the issue. Compensation schemes in India are plagued by poor delivery, lack of payments as well as high transaction costs incurred by applicants (Saberwal et al. 1994; Ogra & Badola, 2008). Villagers were not keen on the idea of compensation, partly because of the low efficiency of extant schemes. Moreover, most compensation schemes are designed for large mammals that cause sporadic damage as opposed to macaques that co-inhabit spaces and share resources with people. Mitigation measures here need to sidestep the compensation issue as it is unlikely to be a long term solution, and in some instances actually aggravate the problem (see Bulte & Rondeau 2005 for the undesirable outcomes of compensation schemes). Moreover, it may be difficult for the local community to come up with workable solutions on their own accord. There is thus a need for external agencies to build links and engage with communities to find working solutions.

Relocation has been an option, and a group of people in the study village tried to relocate a macaque troupe on their own accord. Success of the relocation was limited. The removal of problem animals and their release in other places has occurred in many parts of India, sometimes without the consent or awareness of people living near the locality of release (Athreya, 2006), or without following appropriate rehabilitation protocols (Panwar & Mishra, 2004). The major disadvantage of relocation is that it could lead to a transfer of conflict and affect human lives near the site of release. Conservationists thus argue that it might be better to find *in situ* solutions to conflict rather than use relocation as a mitigation tool (Linnell et al. 1997).

Mitigating conflict requires testing combinations of a multifaceted approach: (1) increasing fodder and foraging space for macaques, (2) more intensive guarding of crops, potentially through a village-based guarding system, (3) cultivating alternative crops that are not damaged by macaques, and (4) creating a village-based fund for compensating less well-off individuals for whom crop loss is disproportionately higher than their income. However, implementing such approaches is fraught with difficulties and requires both community- and individual-level willingness to participate. Ironic as it may sound, high-levels of conflict seem to be the most prominent agent that might catalyse

cooperative action in the area. Village (*panchayat*) governance systems and government-aided microfinance schemes are extant in all the study sites, and these local institutions are potential candidates for collaborative intervention.

Further study is thus required to find effective solutions to the problem, as the human-macaque overlap continues to increase. Key areas for future research include: (1) determining the extent of human-macaque across the region and comparing its magnitude to that of other species such as large carnivores or elephants, (2) examining the relative importance in loss of subsistence vs. cash crops for farmers or householders, and (3) field-testing the effectiveness of various protection measures over a decent temporal scale that takes into account macaques' abilities to adapt and change their behaviour. It is perhaps inevitable that some amount of conflict will occur wherever humans co-inhabit space with macaques. There is a need for an intervention-based project that directly tackles issues through practice. This will not only add to existing academic work, but would contribute to an overall project of fostering peoples' tolerance and acknowledging the presence of macaques as part of the fabric of social life.

REFERENCES

- Athreya, V. (2006) Is relocation a viable management option for unwanted animals? The case of the Leopard in India. *Conservation and Society*, 4(3): 419-423.
- Barua, M. et al. (*in press*) Mutiny or clear sailing? Examining the role of the Asian elephant as a flagship species. *Human Dimensions of Wildlife*.
- Boulton, A.M. et al. (1996) The Barbados vervet monkey (*Cercopithecus aethiops sabaesus*): changes in population size and crop damage 1980-1994. *International Journal of Primatology*, 17: 831-844.
- Browne-Nunez, C. & Jonker, S.A. (2008) Attitudes toward wildlife and conservation across Africa: a review of survey research. *Human Dimensions of Wildlife*, 13(1): 47-70.
- Bulte, E.H. and Rondeau, D. (2005) Compensating wildlife damages may be bad for conservation. *Journal of Wildlife Management*, 69(1): 14-19.
- Census of India (2001) www.censusindia.net [Retrieved 14 February 2010]
- Conover, W. J. (1980) *Practical Nonparametric Statistics*, 2nd ed. New York: John Wiley and Sons.
- Das, B.M. (1987) *The people of Assam*. New Delhi: Gian Publishing.
- Dutt, M.N. (1987) *Valmiki Ramayana* (English Translation). Patna: Eastern Book House.
- Fargey, P.J. (1992) Boabeng-Fierna Monkey Sanctuary – an example of traditional conservation in Ghana. *Oryx*, 26: 151-156.
- Gupta, A.K. (2001) Non-human primates of India: an introduction. *Envis Bulletin: Wildlife and Protected Areas*, 1(1): 1-29.
- Hill, C.M. (2000) A conflict of interest between people and baboons: crop raiding in Uganda. *International Journal of Primatology*, 21: 299-315.
- Imam, E. et al. (2002) A successful mass translocation of commensal rhesus monkeys *Macaca mulatta* in Vrindaban, India. *Oryx*, 36(1): 87-93.
- IUCN (2010) *Macaca mulatta*. In: IUCN Redlist of Threatened Species, Version 2010.4 www.redlist.org [Retrieved: 14 February 2010]
- Kipling, J.L. (1904) *Beast and man in India*. London: MacMillan and Co. Ltd.
- Knight, J. (2003) *Waiting for wolves in Japan: an anthropological study of people-wildlife relations*. Oxford: Oxford University Press.

- Lee, P.C. and Priston, N.E.C. (2005) Human attitudes to primates: perceptions of pests, conflict and consequences for conservation. In Paterson JD (Ed.) *Commensalism and conflict: the primate-human interface*. Winnipeg, Manitoba: Hignell Printing. P. 1-23.
- Linnell, J.D.C. et al. (1997) Translocation of carnivores as a method for managing problem animals: A review. *Biodiversity and Conservation*, 6: 1245-1257.
- Malik, I. (1992) Introduction. In Schwibbe, MH & Malik, I (Eds.) *Primate Report: Primatology in India*. 34: 3-4
- Medhi, R. et al. (2007) Status and diversity of temple primates in northeast India. *Primate Conservation*, 22: 135-138.
- Myers, N. et al. (2000) Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.
- Naughton-Treves (1997) Farming the forest edge: vulnerable places and people around Kibale National Park, Uganda. *Geographical Review*, 87: 27-46.
- Ogra, M.V. (2008) Human-wildlife conflict and gender in protected area borderlands: A case study of costs, perceptions and vulnerabilities from Uttarakhand (Uttaranchal), India. *Geoforum*, 39: 1408-1422.
- Ogra, M.V. and Badola, R. (2008) Compensating human-wildlife conflict in protected area communities: ground-level perspectives from Uttarakhand, India. *Human Ecology*, 36(5): 717-729.
- Panwar, H.S. and Mishra, M. (2004) The monkey and the lion. *Zoo's Print*, 9:12.
- Pirta, R.S. et al. (1997) Management of the Rhesus Monkey *Macaca mulatta* and Hanuman Langur *Presbytis entellus* in Himachal Pradesh. *Biological Conservation*, 79: 97-106.
- Priston, N.E.C. (2005) Crop raiding by *Macacca ochreata brunnescens* in Sulawesi: reality, perceptions and outcomes for conservation. PhD Thesis. University of Cambridge.
- Riley, E.P. & Priston, N. (Forthcoming) Macaques in Farms and Folklore: Exploring the Human-Nonhuman Primate Interface in Sulawesi, Indonesia. *American Journal of Primatology*.

- Saberwal, V.K. et al. (1994) Lion-human conflict in Gir Forest, India. *Conservation Biology*, 8(2): 501-507.
- Sinha, A. (2001) The Bonnet Macaque Revisited: Ecology, Demography and Behaviour. *Envis Bulletin: Wildlife and Protected Areas*, 1(1): 30-39.
- Southwick, C.H. and Siddiqui , M.F. (1988) Partial recovery of a new population estimate of rhesus monkey populations in India. *American Journal of Primatology*, 16: 187-197.

APPENDIX 1: Survey Questionnaire

Date:	Village & Location:	Coordinates:
Name of person:		Farm No:
<hr/>		
Age:	Gender:	
Level of Education:	Occupation:	
Land owned:		
Exposure to HMC: Crop-raiding / Stealing / Attacked / Mauled		
<hr/>		

Attitudes to Macaques

Cultural Values

1. Macaques (a) have religious attributes (b) had them in the past but not anymore (c) never had religious attributes (d) no opinion

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

2. Macaques are disciples of Ram: (a) Yes (b) Had them in the past but not anymore (c) never (d) no opinion

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This is true for (a) Temple macaques (b) Village macaques (c) Reserve macaques (e) None (f) No opinion

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

3. Macaques are companions of Hanuman : (a) Yes (b) Had them in the past but not anymore (c) never (d) no opinion

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This is true for (a) both temple and village macaques (b) temple macaques (c) village macaques (d) neither (e) no opinion

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

Attitudes

4. Macaques are likable

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

5. Macaques have a right to live in their environment

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

6. Macaques are a pleasure to live with
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree
7. Macaques should live in:
(a) Urban areas []
(b) Villages []
(c) Temples []
(d) Reserves []
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree
8. Macaques are important and we need to conserve them
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree
9. Assam is better off without macaques
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree
10. I would be willing to spend money for conserving macaques
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

Conflict

11. How bad is the problem?
(1) No problem (2) Not serious (3) Fairly serious (4) Serious (5) Very serious
12. Perception and extent of damage
- Please list all the crops that you grow and the percentage that is damaged by macaques annually.
 - Time spent by monkeys in farms when people are absent (mins)
 - Time spent by monkeys in farms when people are present (mins)
 - Number of raids per day
 - Number of raids per week
 - No. of monkeys raiding
 - Time of raiding: (a) morning (b) midday (c) evening (d) night-time (e) any time
 - Which month does crop-raiding occur? Jan / Feb / Mar / Apr / May / Jun / Jul / Aug / Sep / Oct / Nov / Dec
 - How much time do you spend (a) guarding crops from macaques every week ____ hours (b) chasing macaques ____ hours
13. Women more affected by macaques than men
(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree
(1) Disagree (2) No opinion (3) Agree
14. I would be willing to have macaques in my locality if they destroyed not more than:
(1) 5% (2) 10% (3) 20% (4) 30% (5) 40% (6) 50% of my crops
15. By what % have you decreased planting crops because of macaques?
(1) 5% (2) 10% (3) 20% (4) 30% (5) 40% (6) 50% of my crops

16. What protection measures have you taken against macaques in your farm and home:

Category	Yes / No	Effectiveness (Low, Medium, High)
(1) Fences		
(2) Dogs		
(3) Chemical deterrents / Poison		
(4) Playback of alarm		
(5) Guarding / Chasing		
(6) Noise / Bells / Shouting		
(7) Painting individuals		
(8) Stones / Slingshots / Bow & Arrow		
(9) Shooting / Hunting		
(10) Trapping		
(11) Translocation		

Attitudes to Management Strategies

17. Macaques should be protected by law

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

18. Populations of macaques should be controlled

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

19. Macaques in villages should be managed by (a) local people (b) forest department (c) NGOs (d) no management

20. Macaques in temples should be managed by (a) local people (b) forest department (c) NGOs (d) temple committee (e) no management

21. Macaques should be killed

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

22. Macaques should be trapped and relocated

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

This holds for (1) Temple Macaques (2) Village Macaques (3) Reserve Macaques (4) None

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

They should be taken to (a) reserves (b) temples (c) other villages (d) zoos

This should be done by (a) local people (b) forest department (c) NGOs (d) temple committee

23. I would be willing to pay for macaque relocation

24. I would be willing to pay for a village-based protection scheme

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

25. I would be willing to take up planting alternative crops

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

26. Compensation is a good method for addressing this problem

(1) Disagree (2) Mildly Disagree (3) No opinion (4) Mildly Agree (5) Agree

Compensation should be paid by (a) money collected from villagers (b) government (c) NGOs
(d) temple committee