

## Public opinion regarding Human-Monkey conflict and conservation of non-human primate in Sepahijala District of Tripura

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### Abstract

Human and non-human primates are integral parts of nature but their proximity to food resources and habitat has become a survival threat to many non-human primates. The questionnaire survey was conducted in 6 villages of Sepahijala district from January 2021 to April 2021. Majority of individuals of these six villages belonged to middle SES. Significant number of respondent claimed that only *Macaca mulatta*, *Trachypithecus phayrei* *Trachypithecus pileatus* causes considerable damage to crops, household material and devour various fruiting plants throughout the year. Respondents use passive deterrence methods and active prevention methods so that the nonhuman-primate does not enter the crop field and the household. Due to the increase in rubber cultivation over the years, primates have been forced to change their habitat. Across the study area, all respondents supported the proposal to conservation of nonhuman-primate in that area and their request to the Forest Department to take a proactive role in this regard.

**H**uman and non human primates are integral parts of the nature. They are living together and shared ecological and social environment for many years<sup>22</sup>. Excessive demands for food resource and shelter lead to a more aggressive behavior among them.

Human-nonhuman primates conflict has a negative impact on the conservation of Biodiversity and the lives of the poorest peasants and nonhuman primate in the village are characterized by severe adversity which destroys their food grains and disrupts their

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livelihood<sup>1,30,41</sup>. During this time, crop damage by nonhuman primate in and around various protected areas in Asia and Africa has had a profound effect<sup>2,14,26,31,42,47,51,58,59,61</sup>. No special research has been done in South Tripura district on crop damage by nonhuman primate, raiding the fruiting plants and destruction of households. However, within the Asian continent, in India, the conflict between human and non-human primate are increasingly emerging. However, There is no systematic records or centralized database recording such conflicts; Hence, this work represent the document the level of conflicts between humans and non-human primates for the purpose of adopting measures for primates conservation in and around densely populated human settlements.

Crop raiding and damaging are a ecologically salient properties of primates living in human settlements, but it also makes their ability to deal with humans more difficult<sup>42</sup>. When there is a shortage of food in the forest, high quality and easily digestible human food is a good alternative source of nutrition for primates, Which may be the most important factor of the intensity of the crop raiding<sup>28</sup>. In many tropical countries some primates are able to successfully exploit agricultural crops mainly due to their behavioral adaptability, intelligence, the nature of being opportunistic frugivorous and the general diet system<sup>15,24,38</sup>. Species that are malleable in behavior and capable to adequate to human-induced habitat are often forced to compete directly with humans for food and shelter and are caught as significant crop contagion<sup>56</sup>. The practice of crop snatching, therefore, reduces crop pest tolerance in question and may add another level of dimension of threat to already endangered species<sup>10</sup>.

The study was conducted in Sepahijala

district of Tripura, mainly nearby Sepahijala wildlife sanctuary, Ashabari and Kathalia forest area and nearby rubber plantation close to them. Maximum number of people in Sepahijala district planting Rubber plantation due to it help economically strong of the indigenous tribal communities and most of the farmers change their practices of crop pattern as a result non-human primate facing challenges for food, shelter and safety. There is no study available related to the local people opinion about the crop damage by non-human primate, human-nonhuman primate conflict and attitudes of the local community towards conservation of the non-human primate in Sepahijala district of Tripura. Therefore, the present study provides data about Socioeconomic condition of people related to emerging conflict area, estimating the level of crop damage and quantify people's attitudes towards non-human primate conservations.

#### *Study area :*

This study was conducted in Ashabari (23.6197°N, 91.1630°E), Baghaichar (23.3884°N, 91.3001°E), Dakhin Mohespur (23.3632°N, 91.3184°E), Jangalia (23.6625°N, 91.2930°E), Kanaibari (23.6402°N, 91.2875°E) and Modhya Brajapur area (23.6458°N, 91.2664°E) of Sepahijala district of Tripura. Total geographical area of the District is 1043.04 Square Kilometers. As per Data of Census 2017, total population of the District is 5, 42,731. People from various communities inhabit the District. Bengali, Kok-Borok and various other native tribal languages are spoken by the people. (<https://sepahijala.nic.in/>).

In Sepahijala district five Primate Species are present (wildlife resource of Tripura, 2021; <https://sepahijala.nic.in/tourist-place/sepahijala-wildlife-santuary/>). The respondents therefore had a good chance of encountering primates on a regular basis. We

selected the study villages into two categorized sites -1) three villages which is nearby reserve forest area and maximum rubber plantation were present; 2) three villages which is nearby wildlife sanctuary and minimum rubber plantation were present.

*Data collection :*

Information on human-primates conflict was collected through administering questionnaire surveys in six villages of the South Tripura. Interviews were conducted using a questionnaire from January 2021 to April 2021. A total of 120 individuals were randomly interviewed. Data were collected by research scholar who was familiar with the local inhabitants. First, we informed the interviewees of the aims and objectives of the study and attempted to make them feel confident participating in the research. The interviews were conducted with the household head, the wife of the household head or with resident adults ( $\geq 18$  years) who are willing to participate in an interview as a representative of the family. Participants were divided into

age groups that, broadly defined, covered young adulthood (18 to 35 years), middle age (36 to 55 years), and older adulthood (56 years and older)<sup>46</sup>. Each interview was conducted in the Bengali language. The question asked for an assessment of the respondents thought about crop damage by monkey and concerning the conservation of primates in the area (Annexure -1).

*Statistical analysis :*

Pearson Chi-square tests were used to evaluate differences in the answers of respondents. For all tests  $p \leq 0.05$  was considered to be statistically significant. Maximum of the statistical analyses were executed using the Statistical Package for Social Sciences version 22, (IBM SPSS, Java). Only Socio Economic Status (SES) of six villagers was investigated by following Kuppaswami's rural SES scale updating for 2007 with some modifications according to the need of the present study<sup>35,60</sup>.

**Annexure -1. Framework of the semi-structured interview.**

1. Does any wild animals damage your crops and homestead?	yes / no If yes, then
2. Are you afraid to see Primates?	yes/no
3. During what season do the primates damage the most crops?	Throughout the year/Fruiting Season
4. What kind of damage is done to the paddy field by the Primates?	
5. Do primates visit your homestead	yes/no; if yes -rarely/ sometimes/ frequent
6. Do primates eat and damage the fruiting plants of your house?	
7. Does Primates affliction of human?	yes/no
8. Which methods do you use to protect your crops?	
9. Have you ever seen/heard someone shooting/trapping a crop raider? If yes, then ask: Did the person kill the animal or injure it?	
10. Do you observe any change of habitats since primates came to the year? If yes? What is the change?	
11. Would you like to conserve primates in your area? a) Like b) dislike c) don't know if you like, please state why you would like.	
12. What is your opinion towards establishing a gazette area/ park for primate's conservation? a) positive b) negative c) don't know if positive, please state the reasons.	

Table-1. Socio-Demographic Features of Informants Collected During Questionnaire Survey.

Variables	Name of survey area					
	villages which is nearby reserve forest area and maximum rubber plantation			villages which is nearby wildlife sanctuary and minimum rubber plantation		
	Ashabari (n=20)	Baghaichar (n=20)	Dakhin Mohespur (n=20)	Jangalia (n=20)	Kanaibari (n=20)	Modhya Brajapur (n=20)
<b>1. Gender</b>	n (%)					
(a) Male	17(85)	18(90)	17(85)	15(75)	16(80)	15(75)
(b) Female	3(15)	2(10)	3(15)	5(25)	4(20)	5(25)
<b>2. Age groups</b>	n (%)					
(a) Adulthood(18-35 years)	3(15)	9(45)	7(35)	7(35)	2(10)	10(50)
(b) Middle age(36-55 years)	10(50)	9(45)	11(55)	9(45)	16(80)	8(40)
(c) Older adulthood (56 years and older)	7(35)	2(10)	2(10)	4(20)	2(10)	2(10)
<b>3. Education</b>	n (%)					
(a) Degree course	4(20)	2(10)	1(5)	3(15)	1(5)	1(5)
(b) Higher secondary	2(10)	3(15)	4(20)	3(15)	3(5)	1(5)
(c) Madhyamik	2(10)	3(15)	8(40)	3(15)	11(55)	4(20)
(d) Senior basic	5(25)	8(40)	4(20)	4(20)	4(20)	9(45)
(e) Primary level	7(35)	4(20)	3(15)	7(35)	1(5)	5(25)
<b>4. Occupation</b>	n (%)					
(a) Profession	2(10)	2(10)	1(5)	-	4(20)	2(10)
(b) Semi-profession	1(5)	-	1(5)	2(10)	-	-
(c) Rubber owner/Farmers	2(10)	5(25)	5(25)	1(5)	8(40)	-
(d) Skilled worker	6(30)	8(40)	7(35)	3(15)	6(30)	10(50)
(e) Semi-skilled worker	6(30)	2(20)	5(25)	6(30)	2(10)	8(40)
(f) Unskilled worker	3(15)	1(5)	1(5)	8(40)	-	-
<b>5. Family income per Month</b>	n (%)					
(a) ≥ 19575	2(10)	2(10)	1(5)	2(10)	4(20)	2(10)
(b) 9788-19574	2(10)	4(20)	4(20)	4(20)	7(35)	-
(c) 7323-9787	7(35)	7(35)	12(60)	5(25)	6(30)	9(45)
(d) 4894-7322	6(30)	6(30)	2(10)	9(45)	3(15)	9(45)
(e) 2936-4893	3(15)	1(5)	1(5)	-	-	-
(f) 980-2935	-	-	-	1(5)	-	-

**SES (Socio economic status)**

<b>SES (Socio economic status)</b>						
<b>Low SES</b>						
number of families	8	5	3	7	1	8
Percent representation	40%	25 %	15%	35%	5%	40 %
Score (Mean $\pm$ SEM)*	8.62 $\pm$ 0.49	9.4 $\pm$ 0.40	8 $\pm$ 0.57	9.14 $\pm$ 0.14	-	9.5 $\pm$ 0.189
<b>Middle SES</b>						
number of families	10	13	16	11	15	10
Percent representation	50%	65%	80%	55%	75%	50%
Score (Mean $\pm$ SEM)*	15 $\pm$ 1.17	15.07 $\pm$ 0.92	15.06 $\pm$ 0.79	15.54 $\pm$ 1.19	15.86 $\pm$ 0.84	13.40 $\pm$ 0.22
<b>Upper SES</b>						
number of families	2	2	1	2	4	2
Percent representation	20%	10%	5%	10%	20%	10%
Score (Mean $\pm$ SEM)*	27.5 $\pm$ 0.50	27.5 $\pm$ 0.50	-	27.5 $\pm$ 0.50	26.75 $\pm$ 0.47	27 $\pm$ 1.001

\*Total scores on Education, Occupation and Income

In this study, 120 people (Ashabari -20; Baghaichar -20; Dakhin Mohespur -20; Jangalia -20; Kanaibari -20; Modhya Brajapur -20) were interviewed. The age of respondents are minimum 18 years and above. Most of the respondents were male and fewer were female respondents. The age group of maximum respondents was 36-55 years. Most informers of Ashabari area and Jangalia area were Primary level of education (35%, 35%, respectively), most respondents of Baghaichar area and Modhya Brajapur area were senior basic level (40%, 45%, respectively), in case of Dakhin Mohespur area and Kanaibari area most of them had Madhyamik qualified (40%, 45%, respectively). Besides during the interview we had consulted with the Rubber owner, farmers, traders, service holders, house wife, daily worker, shop owner, old age people. Majority of the informers of these villages were daily labour in rubber plantation area and Agricultural field farmers. Maximum numbers of respondents work for the Government implemented NREGS. Most of the respondent

of these villages family income per month near about Rs 7323-9787/- and The analysis of the education, occupation and income of the respondents, it was found that maximum number of respondent belonged to Middle SES scale, moderate number of people belonged to low SES scale and very few respondents belonged to upper SES scale. The Mean  $\pm$ SEM value of SES score of these villages lie in between 8.62  $\pm$  0.49 to 27.5  $\pm$  0.50, 9.4  $\pm$  0.40 to 27.5  $\pm$  0.50, 8  $\pm$  0.57 to 15.06 $\pm$  0.79, 9.14  $\pm$  0.14 to 27.5 $\pm$ 0.50, 15.86 $\pm$ 0.84 to 26.75  $\pm$  0.47 and 9.5  $\pm$  0.189 to 27  $\pm$  1.001, respectively.

Most of the people of Sepahijala Tripura are currently engaged in both rubber plantation and agricultural activities but maximum number of people has minimum education level. So the family income derives from selling Rubber sheet and agricultural crop. Analyzing these circumstances scientifically, it was observed that a major portion (>50%) of individuals of the six village respondents

belonged to middle SES. When we compare the Socio Economic Status of the respondents in two categorized site (1-Villages near by maximum rubber plantation and reserve forest area; 2-Villages near by minimum rubber plantation and wildlife sanctuary area) it was observed that, the demographic and socioeconomic profile of the respondents differ significantly among the villages in terms of gender ( $\chi^2 = 30.330$ , d.f.=1,  $P=0.001$ ), age class ( $\chi^2 = 50.965$ , d.f.=4,  $P=0.001$ ), education ( $\chi^2 = 105.992$ , d.f.=16,  $P=0.001$ ), occupation ( $\chi^2 = 109.194$ , d.f.=20,  $P=0.001$ ) and family income per month ( $\chi^2 = 53.354$ , d.f.=12,  $P=0.001$ ).

*Impression of seeing Primates :*

When asked the question “Does any wild animals damage your crops and homestead? and are you afraid to see Primates?” All respondents had observed Rhesus macaque, Capped langur and Phayre’s leaf Monkey damage crops and visit homestead. Few respondents (13.33%) being unafraid of seeing the Primate. Maximum number of respondents (86.66%) feared that Rhesus macaque, Capped langur regarded them as clever and was capable of identifying a human who had harmed them and would even attack a guilty human if they were alone. Few people have suffered injuries from Rhesus macaque and Phayre’s leaf Monkey attacks. Villagers from maximum rubber plantation and reserve forest area feared these primate species more (90%) than those from the minimum (83.33%) rubber plantation and wildlife sanctuary areas ( $\chi^2 = 1.333$ , d.f.=1,  $P=0.248$ ). Most of these respondents were fearful of the notorious behavior of Rhesus

Macaque, Capped langur and Phayre’s leaf Monkey. Their ability to identify and exact revenge on peoples who had offended or harmed them previously (by attacking them). Several recent studies have delivered that Rhesus Macaque can be detrimental. There is also ample evidence regarding human-Monkey conflict in Khowai district of Tripura, Badarpurghat and Karimganj of Assam, Chitrakoot in Madhya Pradesh, Jodhpur in Rajasthan, Shivapuri-Nagarjun National Park of Nepal, Rampur Village under Monohardi Upazila in Narsingdi District of Bangladesh<sup>3,4, 11,17,18,55</sup>, the perception of Rhesus macaque<sup>6</sup>, agonistic interactions between humans and monkeys<sup>12,13</sup>.

*Seasonal Aspect of Crop Damage and problems caused by primate in Paddy field:*

The majority (66.66%) of the respondents claimed that primate cause damage the crop throughout the year, whereas 33.33% reported that greatest amount of damage during the fruiting season. However, there is no significant difference among the respondents experiences regarding the seasonal aspect of crop damage ( $\chi^2 = 0.150$ , d.f.=1,  $P=0.699$ ) (Table-2).

The majority (83.33%) of the respondents claimed that Rhesus Monkey and Capped langur devour and damage the mature paddy and seedlings of paddy in agricultural field, whereas 16.66% reported that paddy field doesn’t effect by primates (Table-2). However, there is no significant differences were identified among the respondents experiences regarding primates devour and damage the paddy field ( $\chi^2 = 1.536$ , d.f.=1,  $P=0.215$ ).

Table-2. Distribution of responses (N=120) in relation to the question “During what season do the primates damage the most crops? and What kind of damage is done to the paddy field by the Primates?”

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Crop damage in relation to season	Throughout year	66.66% (40)	66.66% (40)	0.150	1	0.699
	Fruiting season	33.33% (20)	33.33% (20)			
Paddy field damage by primates	Yes	83.33% (50)	83.33% (50)	1.536	1	0.215
	no	16.66 % (10)	16.66 % (10)			

The relationship between temporal forest fruiting patterns and crop raiding by wildlife is highly complex in tropical regions<sup>16</sup>. Agricultural crops and some fruits were raided throughout the year due to exhibiting no definite fruiting season such as banana and papaya in Java<sup>57</sup>, Cassava in Sumatra<sup>45</sup>, immature coconut in Zanzibar<sup>56</sup>, arena palm in Indonesia<sup>48</sup>. The present study similarly found both strong seasonality and non-seasonality in the temporal patterns of crop damage caused by primate. These suggest that throughout the year Rhesus macaque, Capped langur and Phayre’s Leaf Monkey visit agricultural field and rubber plantation area and damage various crop and seedling of rubber tree. Most of the time, it was observed that paddy is the preeminent crop that devour and destroyed by Rhesus macaque and Capped langur. Ashan and Uddin<sup>3</sup> has also found the same pattern of results in Rampur Village under Monohardi Upazila in Narsingdi District of Bangladesh.

*Primates visits homestead and causes any problems :*

All respondent had observed Rhesus macaque, Capped Ingur and Phayre’s leaf Monkey in their homestead. When asked “How often do Primates come to visit your homestead,” the majority (59.16%) answered ‘frequently’, 34.16% stated ‘occasionally’ and few (6.66%) reported ‘rarely’ (Table-3). There were no differences between the two conservation status categories in this respect ( $\chi^2 = 1.720$ , d.f.=4, P=0.787; Table-3). However, 65% of the households nearby maximum rubber plantation and reserve forest areas and 53.33% of those in minimum rubber plantation and wildlife sanctuary areas reported that Rhesus macaque, Capped langur and Phayre’s leaf Monkey frequently raided their homestead.

Respondents (88.33%) reported that Rhesus macaque, Capped langur and Phayre’s leaf Monkey were creating problem when

Table 3. Frequency of Primates visits to homestead and causes problem in the area

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Experienced Primates visits to your homestead	Rarely	5% (3)	8.33% (5)	1.720	4	0.787
	Occasionally	30% (18)	38.33% (23)			
	Frequently	65% (39)	53.33% (32)			
Household items damage by primate	Yes	86.66% (52)	90% (54)	1.026	1	0.311
	No	13.33% (8)	10% (6)			

entering the homestead. The most common problem was household disturbances (breaking roof tiles, damaging furniture's, stealing food, tear off clothes, damage pile of straw), but only 11.66% respondent stated that Monkey doesn't enter the room (Table-3). The respondent's view of household disturbances did not differed significantly between the two different areas ( $\chi^2 = 1.026$ , d.f.=1, P=0.311; Table-3). People nearby minimum rubber plantation and wildlife sanctuary area claimed that primates damage the household items more (90%) than those from nearby maximum (86.66%) rubber plantation and reserve forest areas (Table-3).

Most respondents considered monkey to be problematic animals due to their crop raiding and household disturbance. Most of the studies have provided evidence that primate can be problematic pest animals. Das and Mandal<sup>17</sup>; Deb *et al.*,<sup>14</sup>; Chaturvedi and Mishra<sup>11</sup>; Sharma *et al.*,<sup>55</sup>; Air<sup>4</sup> and Ahsan and Uddin<sup>3</sup> also found same pattern of results.

When asked the question "Do primates

eat and damage the fruiting plants of your house?" the entire respondent reported that Rhesus macaque, Capped Ingur and Phayre's leaf Monkey damage most of the fruiting plants both the areas. These primate species were causes damage to 17 crop species (Table-4). Villagers nearby maximum rubber plantation and reserve forest area claimed that most destructive tree species is Jackfruit (68.33%). Respondents observed that troop of primate enter in the house and damage various fruiting plants in this area such as Mango (60%), Papaya (41.66%), Rubber (40%), Guava (38.33%) and Banana (31.66%). Only a small proportion of respondents in this area reported that Rhesus macaque damage Jamun (15%), Pomelo (11.66%), Wild sweetsop (11.66%), Jujube (11.66%), coconut (3.33%), Tamarind (3.33%), Persimmons (3.33%), Areca (3.33%), Lychee (1.66%) and Pomegranate (1.66%).

Respondents nearby minimum rubber plantation and wildlife sanctuary area claimed that most destructive tree species is Jackfruit (76.66%). Villagers reported that troupe of primate devour and damage Mango (68.33%),



Papaya (51.66%), Guava (38.33%) in this area, only a small proportion of respondents in this area reported that they were damage Jamun (16.66%), Pineapple (11.66%), Rubber (13.33%), Banana (28.33%), Jujube (5%), Coconut (5%), Pomelo (11.66%), wild sweetsop (6.66%), Lychee (3.33%) and Pomegranate (1.66%). However, there is no significant differences were identified among the respondents experiences regarding primates devour and damage the fruiting plants ( $\chi^2=24.912$ , d.f.=16, P=0.005; Table-4).

From survey it was observed that Rhesus macaque, Capped langur and Phayre's leaf Monkey were damage six main fruiting plants (Jackfruit, Mango, Banana, Guava, Papaya and Rubber) to be a problem year round; a situation which makes the control of damage by wildlife on those six species even more difficult. In Indonesia Long-tailed macaque damage 14 plants species when entering homestead and most destructive plant species is rubber and oil palm<sup>36</sup>. Aziz and Feeroz<sup>7</sup> reported that Rhesus Macaques raid

Table-4. Distribution of the damaging fruiting plants in each study sites (percentage of interviewees).

Plants species	Villages nearby maximum rubber plantation and reserve forest areas (N=60)	Villages nearby minimum rubber plantation and wildlife sanctuary areas (N=60)	Final logistic model		
			$\chi^2$	D.f.	P=
Banana ( <i>Musa</i> spp.)	31.66	28.33	24.912	16	0.005
Mango ( <i>Mangifera</i> spp.)	60	68.33			
Rubber ( <i>Hevea brasiliensis</i> )	40	13.33			
Pineapple ( <i>Ananas comosus</i> )	8.33	11.66			
Jackfruit ( <i>Artocarpus heterophyllus</i> )	68.33	76.66			
Papaya ( <i>Carica papaya</i> )	41.66	51.66			
Guava ( <i>Psidium guajava</i> )	38.33	38.33			
Jamun ( <i>Syzygium cumini</i> )	15	16.66			
Pomelo ( <i>Citrus maxima</i> )	11.66	11.36			
Wild sweetsop ( <i>Annona reticulata</i> )	11.66	6.66			
Jujube ( <i>Ziziphus jujuba</i> )	11.66	5			
Lychee ( <i>Litchi chinensis</i> )	1.66	3.33			
Coconut ( <i>Cocos nucifera</i> )	3.33	5			
Pomegranate ( <i>Punica granatum</i> )	1.66	1.66			
Tamarind ( <i>Tamarindus Indica</i> )	3.33	0			
Persimmons ( <i>Diospyros malabarica</i> )	3.33	0			
Areca ( <i>Areca catechu</i> )	3.33	0			

jackfruits and targeting mature and ripe fruits and sometimes the jackfruits and pineapples (*Annona sativus*) are left scratched and/or half-eaten. Jack fruit (*Artocarpus heterophyllus*), Mango (*Mangifera indica*), Litchi (*Litchi chinensis*), Guava (*Psidium guajava*), Banana (*Musa sapientum*), are the common food plants for both man and Rhesus macaque at Badarpurghat area of Assam<sup>18</sup>. Extensive cutting of forest trees, replacement of natural forests by monoculture of rubber plantation in place of the natural food plants, illegal encroachment of forest lands by greedy people have forced the Rhesus macaques to invade human settlement areas for the sake of their own survival<sup>17</sup>. Most of the villagers inhabiting in the study sites expressed their grievance over the presence of the monkey population in their localities. Habitat destruction and their natural habitat, increasing monkey population and improper waste disposal are the major causes of conflicts with humans in Assam in India and Narsingdi District of Bangladesh<sup>3,20</sup>. With the expansion of human settlements and consequent decline of the habitats most of the monkeys of the country have been compelled to become ecological refugees<sup>37</sup>.

#### Affliction of human by Primate's :

When asked the question “Does Primates affliction of human?” 80% respondents claimed that Rhesus macaque, Capped langur and Phayre’s leaf Monkey were injuring and attacking human. Few respondents (20%) reported that primate not effect on human. In this point of view there is no significant difference both the sites ( $\chi^2 = 0.234$ , d.f.=1, P=0.628; Table-5). From this study it was observed that some Primates are harmful. In the year 2012, Khatun and her research team<sup>30,31</sup> reported that over the last one hundred years, two people have died and 5 have suffered injuries by *Semnopithecus entellus* attack. Respondents in four districts of Sri Lanka claim that primates bite or scratch people and pets<sup>9</sup>. Some Japanese people are frightened when they see monkeys, claiming that the primate physically disturbs people<sup>33</sup>. It was estimated that an average of 300 monkeys attack visitors to a wild monkey park in Japan each year, which ranges from aggressive displays to actual bites<sup>34</sup>.

Table-5. Frequency of responses in relation to the question “Does Primates affliction of human?”

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Affliction of human by Primate's	Yes	80 (48)	80 (48)	0.026	1	0.872
	No	20 (12)	20 (12)			

*Crop protection measures used by respondents :*

Respondents at both study sites found it difficult to prevent monkeys feeding on crops, although they employed a variety of crop protection methods centered on Passive deterrence methods (Using scarecrow, Fencing and Suspending canes), active deterrence methods that do not cause harm to wildlife (Guarding, Shouting, Slingshots and Throwing stones) and Active deterrence methods that can injure/kill wildlife (Firecrackers, Chasing with Bamboo stick, Chasing with Dog and Chasing with sword). More number of respondents nearby maximum rubber plantation and reserve forest areas using Passive deterrence methods than the villagers nearby minimum rubber plantation and wildlife sanctuary areas to drive away monkeys from crop fields (Table-6). This was usually achieved by installing a tin box in a tree with a stick inside attached to a long rope outside that makes a sound when pulled, prepare scarecrow and fencing the crop field with sharp barbed iron wire, using bamboo and old bicycle tyres. Villagers nearby Gunung Leuser National Park of Indonesia and the people of Monohardi and Keshabpur Upazila of Bangladesh using this type of technique to protect their crop field<sup>3,31,36</sup>.

Maximum numbers of respondents both the sites have used active deterrence methods that do not cause harm to wildlife (Table-6). Guarding, shouting, slingshots and throwing stones were the most effective technique to deter primate from the agricultural field. Respondents prepare taung ghar (local Bengali name, Kokborok name-Gairing) near crop field and alternatively they can cooperate

in a system of rotating guard duty in agricultural field, which would help reduce costs to individuals. Villagers collect mature rubber seeds and areca fruit which they can utilize in the slingshots technique to drive away monkey from agricultural field, home garden and the household. Villagers of Tangail and Jessore district most frequently using guarding technique in the crop field for protection of crops<sup>30,43</sup>. Guiding is a predominant technique that can control the conflict between human and monkey in the household and other organizations. According to many respondents, to keep the social life of the locals intact and monkeys away from human habitation should always be followed this methods<sup>29</sup>. Most of the farmers of Sumatra district in Indonesia have used active deterrence method (shouting) which do not cause harm to primates<sup>31</sup>.

Near about 49.78% respondents both the sites were using active deterrence methods that can injure/kill wildlife. Near about 78.33% of the respondents reported that they were chasing with bamboo stick and beating the primates when they entering crop field and homestead. ~54.16% respondents used effective firecrackers method to prevent crop raiding. A very few number of respondents inform that villagers occasionally were chasing the monkeys with the help of Dog or sword and try to hurting them (Table-6). But they were did not shooting and trapping the wildlife, because the villagers know that if they kill monkeys, Forest department will arrest them which indirectly help wildlife conservation. Respondents in Keshabpur upazila of Bangladesh reported that they did not used killing, shooting and trapping of langurs to prevent crop raiding, especially the Hindus regard them as sacred animals. The positive

Table-6. Percentage of responses according to crop protection methods used at both study sites

Protection methods	Villages nearby maximum rubber plantation and reserve forest areas (N=60)	Villages nearby minimum rubber plantation and wildlife sanctuary areas (N=60)
<b><i>Passive deterrence methods</i></b>		
.Using scarecrow	23.33	13.33
.Fencing	35	31.66
.Suspending canes	20	25
<b><i>Active deterrence methods that do not cause harm to wildlife</i></b>		
.Guarding	71.66	76.66
.Shouting	66.66	60
.Slingshots	68.33	63.33
.Throwing stones	50	41.66
<b><i>Active deterrence methods that can injure/kill wildlife</i></b>		
.Firecrackers	68.33	40
.Chasing with Bamboo stick	76.66	80
.Chasing with Dog	45	31.66
.Chasing with sword	23.33	33.33

findings of this study might be used as a basic protocol for the conservation of common langurs in the study areas<sup>31</sup>. The use of deterrent methods was same in villages in the two different sites, this difference was statistically significant ( $\chi^2=19.178$ , d.f.=10, P=0.05).

#### *Change in primate habitats :*

All the respondents both the sites reported that Rhesus macaque, Capped langur and Phayre's leaf Monkey change their habitat. Utmost number of respondents nearby maximum rubber plantation and reserve forest area claimed that due to rubber plantation increase (56.66 %) day by day Monkey and

Langur moving from one location to another with the help of canopy cover of rubber plants and People nearby minimum rubber plantation and wildlife sanctuary area claimed same type of reports (56.66%; Table-7). Respondents nearby wildlife sanctuary area (26.66%) observed that some unscrupulous peoples had every day cut the forest plants which affect the food and shelter of Primate. This resulted in the shrinkage of primate habitats. 75% peoples nearby reserve forest area provided same consequences. 8 to 10 percent respondents both the sites reported that primate like the home garden vegetables that's why they enter in the homestead and devour and damage the vegetables. Few respondents both the sites

claimed that in the absence of natural predator and very high birth rate, the population of primate is multiplying every year. This has led to increase monkey population and so the amounts of food are not available in the forest according to their population rate. As results, monkeys moved into the locality which causes human-rhesus macaque conflict. No difference was observed between the respondents from both the sites with respect to habitat shrinkage ( $\chi^2 = 3.543$ , d.f.=9, P=0.939).

In the year 2011, Scientist Jinie D.S. Dela<sup>19</sup> reported that *Semnopithecus vetulus nestor* change their habitat due to many large trees that had provided food shelter for langurs were cut down in Srilanka. People of keshabpur Upazila claimed that *Semnopithecus entellus*

change their habitat for same conditions<sup>30</sup>. The population rate of Rhesus monkey has multiplying every year. This has led to increase monkey population and so the man-monkey conflicts increase day by day<sup>18,20</sup>. Khatun<sup>30</sup> and his research team 2012 reported that Langur also prefer Mangos (*Mangifera indica*) even when other natural foods are available in keshabpur Upazila of Bangladesh. The protection of valuable human foods is a significant goal in minimizing crop damage<sup>48</sup>. Naughton-Traves<sup>39</sup> observed that banana raiding decreased when the fruit of *Mimusops bagshawei* increased in Uganda, Africa. It will be important to keep this information in mind when devising methods to enhance Rhesus macaque survival and minimize crop damage in Rhesus macaque-populated areas.

Table-7. Frequency of local's responses to the questions of change in Primates habitat in the area.

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Reason for primates change habitat	Due to deforestation	75 (15)	26.66 (16)	3.543	9	0.939
	Available vegetable in the home garden	10 (6)	8.33 (5)			
	Due to rubber plantation	56.66 (34)	56.66 (34)			
	Competition for food in the forest	8.33 (5)	8.33 (5)			

*Conservation of Primates :*

All the respondents had a positive opinion towards the conservation of primate in the area. Maximum number of respondents reported that if they conserve Monkey, as a result biodiversity will be maintained. 20% people considered primates to be a part of the local heritage of forefathers, enjoyed seeing the Rhesus macaque Capped langur and Phayre's leaf Monkey and thought that the species should be conserved for future generations. Others felt that primate resembled humans or had recreation and aesthetic values. Opinions regarding the value of primate conservation did not differ significantly (although a trend was observed) between the two categorized areas ( $\chi^2 = 13.132$ , d.f.=9, P=0.157; Table-8). However, the respondents said that if the forest department planted various fruiting plants on both sides of the village road, the monkeys would spend more time on those plants.

The overall findings of this study suggest that the majority of respondents have positive attitudes towards wildlife conservation in general, and that positive attitudes towards primates make them a suitable flagship to promote the initiative. Nekaris *et al.*,<sup>44</sup> observed that somewhat similar attitudes in the Southern province of Sri Lanka. More recently, Khatun *et al.*,<sup>30</sup> revealed the same in a case study of the Keshabpur Upazila of Bangladesh. The same patterns of results also observed by Gillingham and Lee<sup>25</sup> and Alexander<sup>5</sup>. Respondents of India, Kenya and Uganda wanted to conserve large mammals because of they were benefited to wildlife and have an aesthetic and ecologic value<sup>22,23,27</sup>. This prevailing pro-conservation sentiment that contrary to predominant assumptions people in the developing world are not completely antagonistic towards commensal wildlife or ignorant of conservation issues.

Table-8. Respondent answers regarding their positive outlook on the conservation of primates in the area

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Positive outlook towards conservation	Protect biodiversity	53.33 (32)	55 (33)	13.132	9	0.157
	Local heritage	20 (12)	20 (12)			
	Recreation	15 (9)	16.66 (10)			
	Aesthetic	11.66 (7)	8.33 (5)			

Opinions on the establishment of a park/gazetted area for the Primates

*Opinions of the respondents towards establishment of a gazetted area/Primates in the area :*

All of the respondents from both the areas supported a proposal of establishing a Primates park in the area. Many believed that they would receive some benefits this proposal and majority of the respondents thought it would create jobs. Another common expectation was that the park would be a source of income through tourism and recreation, which would also be helpful for the development of the area (Table-9). All the respondents requested that if the Tripura Government and the Tripura Forest Department create Small Park and transplant various fruit plants, then the monkeys will spend more time in the park and as a result people will get relief from primate.

This support appears to arise from the belief that locals would derive economic benefits from the establishment of such a park. Previous research suggests that people generally need to have a more positive attitude towards protected areas when profit are associated with the protected area like attitudes towards conservation and wildlife tourism in India<sup>52</sup>, conservation outside of parks in Kenya<sup>23</sup>, the impact of community-based conservation in Nepal<sup>8</sup>, factors influencing conservation attitudes of locals<sup>32</sup> and create job in Keshabpur Upazila of Bangladesh<sup>31</sup>. Therefore, a community-based conservation protocol should be implemented to reduce potential human-primate conflict. Indians are always trying to conserve plants and wildlife.

Human-nonhuman primate like *Macaca*

Table-9. Opinions of the respondents towards establishment of a gazetted area/Primates in the area

Variables	Local experiences	Villages nearby maximum rubber plantation and reserve forest areas % (n)	Villages nearby minimum rubber plantation and wildlife sanctuary areas % (n)	Final logistic model		
				$\chi^2$	D.f.	P =
Answers regarding positive opinion	Job	55(33)	43.33 (26)	7.011	9	0.636
	Tourism	15 (9)	20(12)			
	Recreation	15 (9)	18.33 (11)			
	Development of infrastructure	15 (9)	18.33 (11)			



A-Paddy field damage by Primates



B- Vegetables damage by Primates



Figure-C-Capped langur enter into the rubber plantation; D-Phayre's Leaf Monkey present on fruiting plants; E-Rhesus macaque enter into the rubber plantation.



F



G

Figure F, G-Primate damage the homestead





H



I

Figure-H, I-Primate damage the fruit of Jackfruit and seedling of Banana.



J



K

Figure J- Respondents used Slingshots methods for keeping away the primate;  
K-Respondents prepared Taung ghar and they were Guarding their agricultural field.

*mulatta*, *Trachypithecus phayrei*, *Trachypithecus pileatus* conflict causes a significant problem in the six villages of Spahijala district of Tripura and this situation effect the conservation of non-human primate and disturbs human life. Expansions of rubber plantation and destruction of natural forest are the serious problems that affect the habitation of non-human primate. Crop damaging and disturbance of fruiting plants of household are the main reason of human and primates conflict and its result in declines the population rate of primates and loss of socio-economy of the people. It appears that the positive attitudes of respondents provide a significant source of hope for non-human primate conservation in this area. At last, local people and Forest Department are the major conservationist, if they know what the value of non-human primates is, prevent deforestation and actively participate to conservation plan of non-human primate, this situation will be decrease in future.

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