

An Attitude Assessment of Vulture Conservation Among Three Generations of Residents of The Mudumalai Tiger Reserve, Tamil Nadu, Southern India

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Abstract: The vulture serves as an important and specialized scavenger in human societies, of developing countries, in particular, helps clean the environment and prevents diseases. This study analyses the attitude of three generations of residents to support the conservation of the vulture population in Mudumalai Tiger Reserve (MTR). Semi- structure questionnaires were collected Vulture feeding area MTR, 344 respondents randomly chosen from three different generations, i.e., First generation (n=185), Second generation (n=85), and Recently Settled (n=74) in January to October 2018. Our results showed that Three generation people favorable attitude of vulture conservation ($\chi^2=1.896, p=0.398$). Among the entire group of respondents, the majority (74.6%) claimed that they never persecuted vultures, and (86.9%) are aware that the vultures are beneficial creatures to human beings. Peoples from lower caste (Tribal) and livestock holders show highly attitude in vulture conservation. To succeed in vulture conservation in the study area the strategies should highlight the importance of these scavengers in human societies and also impart change in the personal attitude of residents to favor nature in general.

Key Word: Vulture; Mudumalai Tiger Reserve; Three Generation; Tribal

I. Introduction

Vultures provide critical ecosystem services and serve a useful purpose in human societies by helping clean the environment through consuming carrion and meat waste such as bones and skin (Ogada et al., 2016; Thiollay, 2017). The presence of the vulture in humanized environments therefore may help reduce the risk of diseases outbreak in cities and towns, particularly in developing countries where solid waste management is often not apt (Guerrero et al., 2012). Vulture dominance at a location usually subdues the numbers of mammalian scavengers like dogs and rodents that are known to transfer diseases to humans (Ogada et al., 2012). Therefore, it makes sense that the absence of vultures in humanized environments may likely lead to an increase in the population of these mammalian scavengers and the diseases associated with them. For example, the vulture crisis in India triggered an increase in the population of feral dogs that consumed carcasses in urban areas.

Among the nine species of vultures found in the Indian sub-continent, seven species are recorded in the Mudumalai Tiger Reserve (MTR) namely, White-rumped Vulture (*Gyps bengalensis*), Long-billed Vulture (*Gyps indicus*), Red-headed Vulture (*Sarcogyps calvus*), Egyptian Vulture (*Neophron percnopterus*); (Sashikumar 2001; Shivanan 2004; Subramanya & Naveen 2006; Ramakrishnan et al., 2012) and three migrants namely, Himalayan Vulture (*Gyps himalayensis*) (Praveen 2013), Cinereous Vulture (*Aegyptius monachus*) (Samson et al., 2016) and Eurasian Griffon (*Gyps fulvus*) (Gaja Mohan Raj 2020). In India, the population of white-rumped vultures has declined by more than 99.9% and long-billed and slender-billed vultures have declined by 96.8% in the past two decades (Prakash, et al., 2007, Virani, et al., 2011). Many vulture populations face a variety of threats, notably from

unintentional poisoning particularly with the veterinary drug diclofenac (Green, et al., 2007; Oaks, et al., 2004 and Swan, et al., 2006). In India, secondary poisoning is growing as an emerging threat to the vultures by retaliatory or deliberate poisoning of carcasses has caused significant vulture mortality (Harris, 2013). The deliberate poisoning of carcasses leading to unintentional kill of vultures by the livestock holders and also new establishment of huge power transmission lines on the very important vulture foraging areas have a great impact on the survival of this critical population.

Vultures are a species mostly associated with humanized environments and now that some are critically endangered species, it would be useful to increase the social aspect of research into their conservation to understand attitudes and behaviors of communities living in the area that are likely to have both positive or negative impacts on their survival. This is because most of the current extinction threats emanate from human activities, which can be modified or stopped to support vulture conservation efforts (Heberlein, 2012; Reimer et al., 2013). Holistic empirical information from the social and ecological aspects of vulture conservation is crucial in the designing of efficient conservation interventions to save the bird and its associated ecosystem services (Henriques et al., 2018). Hence, to assess the level of awareness and to understand the public attitude of the residents of MTR, a social survey was conducted between September 2019 and February 2020 among the three generations of settlers in the vulture safe zones since no authentic studies were carried out earlier in the study area. This will be the first of its kind of socio-economic and demographic survey done in MTR to assess the conservative mindset of the public in the vulture foraging areas.

II. Material And Methods

Study Area: Mudumalai Tiger Reserve (MTR) ($11^{\circ}32' - 11^{\circ}43'N$, $76^{\circ}22' - 76^{\circ}45'E$) lies on the northern flank of the Nilgiri Mountain Range in the Western Ghats and is contiguous with Wayanad Wildlife Sanctuary in the west, Bandipur Tiger Reserve in the north, and Nilgiris Forest Division in the south. The MTR also forms part of the Nilgiri Biosphere Reserve. The area is renowned for its rich ecological diversity of flora and fauna. The total area of the MTR is 588.59 km² of which the core zone is attributed to 321 km² (Figure 1).

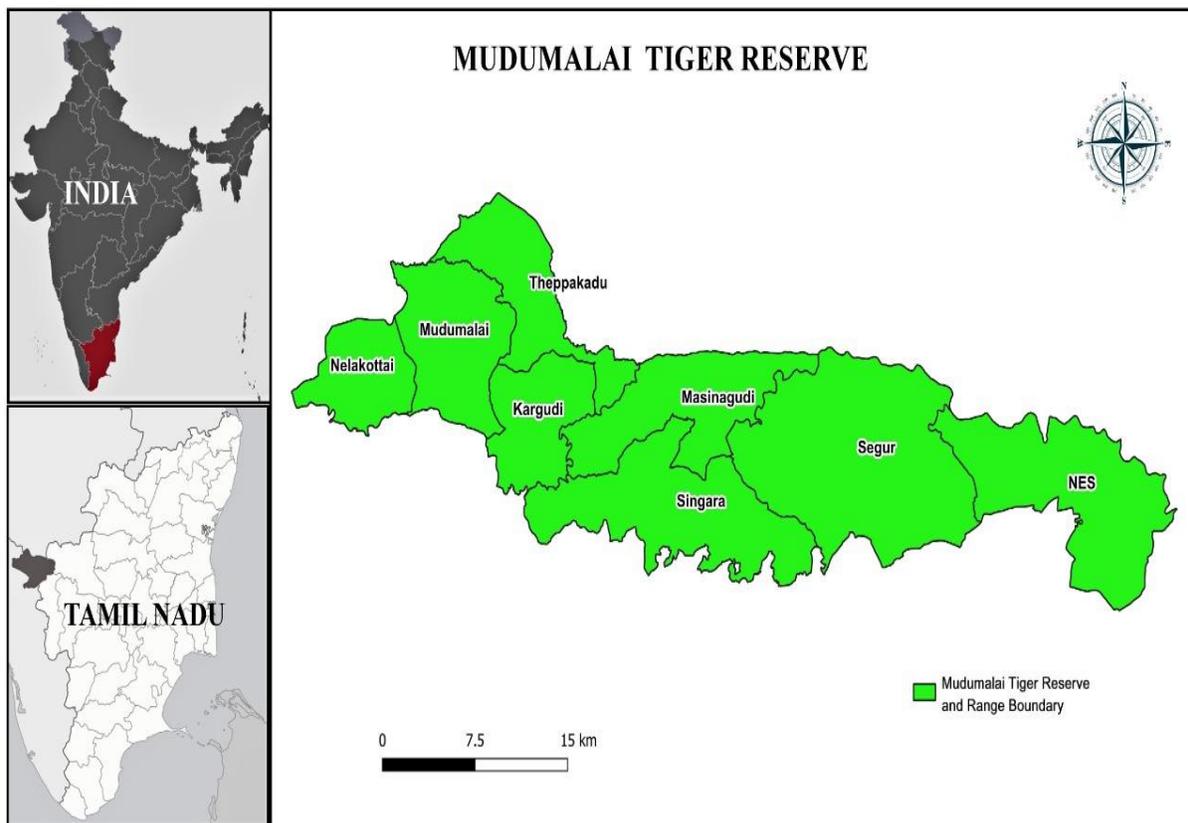


Figure no 1: Map 1. Showing the Study area

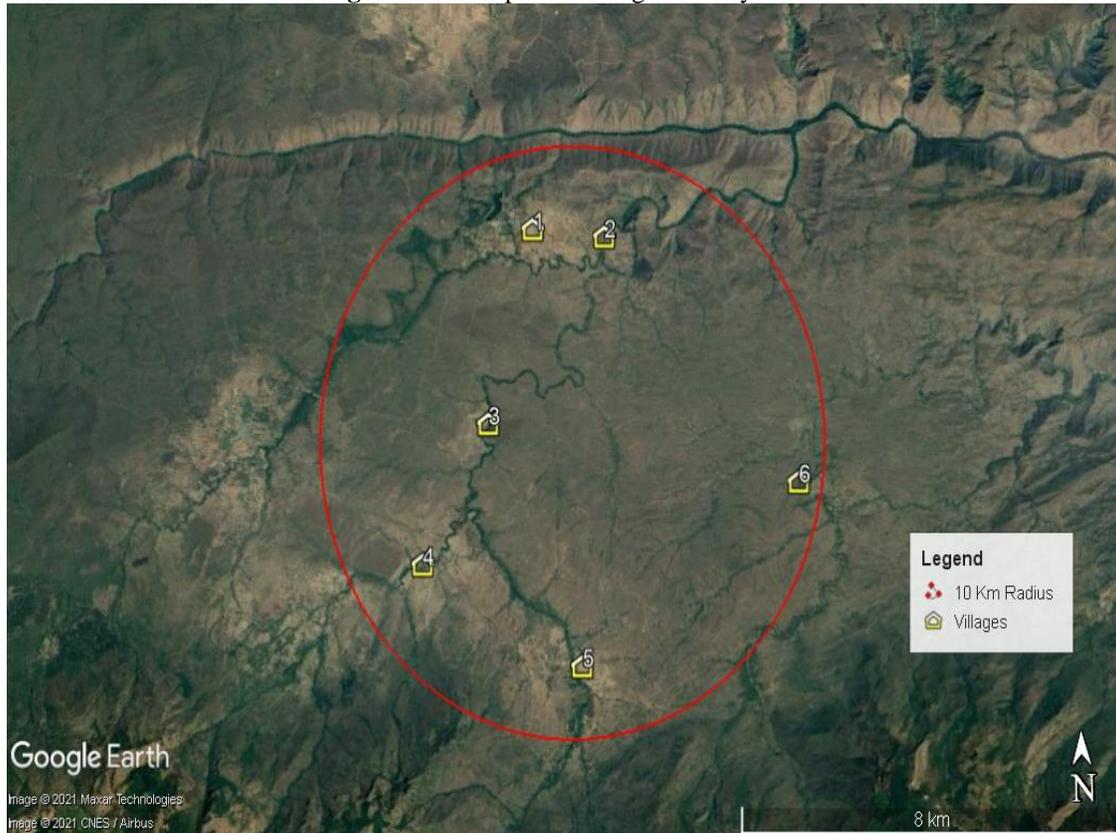


Figure no 2: Map 2. Showing the surveyed villages (Mudumalai Tiger Reserve)

Data Collection: The questionnaire survey was conducted among different sectors of people who live within a 20 km radius of the vulture foraging area, both inside and the peripheries of MTR (Map 2). The survey was conducted in twelve human settlements, of which eight were tribal settlements and the rest non-tribal from September 2019 to February 2020. Perceptions on vulture conservation were collected from 344 respondents randomly chosen from three different generations, i.e., First generation (n=185), Second generation (n=85), and Recently Settled (n=74). Random selection was done by picking pieces of paper with numbers that corresponded to the households from the different study villages as main targets. However, in their absence, a resident, adult (≥ 18 years) in that household had the opportunity to participate in the interview following the method of Gandiwa, et al. 2013. The survey held conditionally on each individual by their local language to encourage the respondents to answer without restraint. This helps the respondents to provide information on questions under investigation even regarded as sensitive. Each respondent to the survey was given assurance on the anonymity of the responses. Each interview was conducted at a respondent homestead and took approximately 20 to 30 minutes to complete per person. Most of the questions asked were open-ended (Ramakrishnan, 2007) to tap into the perceptions of the villagers in a form that was not a priority (Gandiwa, et al. 2013). The questionnaire had specific terms related to the study objectives and all questions were carefully constructed and worded in a way the respondents could understand easily, and presented to each respondent, in the same way, to avoid bias and lead to particular answers (Kasunic, 2005). The questionnaire was also pre-tested in a community adjacent to the study area, and whenever necessary, questions were reframed for clarity. After the completion of the individual survey, cross-checking, and editing, if necessary, was done in the field itself to avoid discrepancies and data inconsistencies. Necessary permission to conduct the study was sought from the relevant authorities well in advance and respondents were informed of the planned interviews one to two days in advance. Frequencies were used to summarise data on respondent's socio-demographic variables and knowledge and perceptions of vultures and their ecological importance are presented in tables and graphs.

Statistical Analysis: The questionnaire data were analyzed with the help of SPSS version 4.2 and MS Excel. We expressed the mean and standard deviation for variables. The association between two variables was tested using the chi-square test with a 95% confidence level.

III. Result

Among the respondents, the gender-based of those interviewed, more proportionate (55%; n=190) were female than male category (45%; n=154). The age category of the respondents ranged from 18 to 80 years old, with a median age of 40 years. The majority of respondents (37%) belonged to the Middle age (26-50 years; n=129), followed by Old age 36% (>51 years; n=124) and Young age constitute 27% (18-25 years; n=91). 70% (n=242) of the respondents belonged to non-tribes, whereas 30% (n= 102) of them were tribal people. The educational qualification of the respondents showed that most of them were illiterate (32%; n=110), followed by graduates (25%; n=86), primary school (23%; n=80), and high school (20%; n=68). From the total households surveyed, (28.2%;n=97) was found as upper-middle-class; poor (26.2% ;n= 90); lower middle class (20%;n=69);very poor (13.1% ;n=45) and remaining (12.5% n=43) was rich (Table 1).

Table no 1: Socio-economic and demographic profiles of surveyed participants across three different generations of the MTR

| Respondents' variables | First-generation (Number and percentage) | Second generation (Number and percentage) | Recently Settled (Number and percentage) | Total |
|-------------------------------|---|--|---|------------|
| Male | 75 (40.6) | 53 (62.4) | 26 (35.1) | 154 (44.8) |
| Female | 110 (59.4) | 32 (37.6) | 48 (64.9) | 190 (55.2) |
| Age-wise classification | | | | |
| 18-25 years | 22 (11.9) | 28 (32.8) | 41 (55.4) | 91 (26.5) |
| 26-50 years | 69 (37.3) | 34 (40.1) | 26 (35.1) | 129 (37.4) |
| Above 51 years | 94 (50.8) | 23 (27.1) | 7 (9.5) | 124 (36.1) |
| Education-wise qualifications | | | | |
| Illiterate | 95 (51.4) | 11 (13.1) | 4 (5.41) | 110 (31.8) |
| Primary school | 46 (24.9) | 22 (25.9) | 12 (16.2) | 80 (23.3) |
| Secondary school | 30 (16.2) | 22 (25.9) | 16 (21.5) | 68 (19.8) |
| College level | 14 (5.6) | 30 (35.1) | 42 (56.8) | 86 (25.1) |
| Caste wise | | | | |
| Tribe | 90 (62.1) | 12 (9.5) | 0 | 102 (29.6) |
| Non Tribe | 30 (15) | 114 (90.5) | 98 (49.2) | 242 (70.4) |
| Source of livelihood | | | | |
| Agriculture | 42 (35) | 31(24.6) | 8 (8.2) | 81 (23.5) |
| Livestock rearing | 58 (48.3) | 23 (18.3) | 0 | 81 (23.5) |
| Employed | 0 | 48 (38.1) | 78 (79.6) | 126 (36.5) |
| Own a business | 20 (16.7) | 24 (19) | 12 (12.2) | 57 (16.5) |
| Economic Status | | | | |
| Very poor | 40 (21.6) | 5 (5.8) | 0 | 45 (13.1) |
| Poor | 60 (32.4) | 23 (27) | 7 (9.5) | 90 (26.2) |
| Lower middle class | 41(22.2) | 16 (18.8) | 12 (16.2) | 69 (20) |
| Upper middle class | 32 (17.3) | 32 (37.6) | 33 (44.6) | 97 (28.2) |
| Rich | 12 (6.5) | 9 (10.5) | 22 (29.7) | 43 (12.5) |

Community dependence on the vulture foraging area:

Firewood and Livestock: To assess the impact and the dependence of the respondents on the vulture forage area we also assessed the community dependence on the land for firewood, the nature of livestock loss for the respondents for the last five years, and the method they used for disposal of the livestock carcass in general. Firewood was found to be the most important source of energy (70.2%) as fuel for households, followed by the use of LPG (26%) and only very few of them (3.8%) used electricity as an alternative source of fuel for cooking (Figure 1).

In the past five years, a total of two hundred and forty-three livestock were lost by eighty-one livestock holders in the study area. Of which, most of the livestock (n=90) were lost due to various diseases, (n=86) livestock were lost due to natural causes and wild animal predation (n=67). Annually an average of about 48.6 livestock was lost by the livestock holders. Among the average annual loss estimated for the past five years, 18 livestock were lost due to natural reasons, 17.2 individuals were lost by disease and 13.5 livestock were lost due to carnivores predation from the wild (Table 2). Among the eighty-one livestock holders interviewed, the majority (n=75) of the

respondents opined that they buried the dead bodies of livestock. Only a small minority (n=6) of livestock farmers opined that they leave the dead carcass in the open area of forest fringes for the scavengers including vulture to feed (Figure 2).

Attitude: The scores of 15 questions were summed to produce an overall score on attitudes towards vultures and their conservation in MTR. The majority (84%) of the respondents opined that the vulture population is declining in the study area. A larger percentage (74.1%) of respondents feel that the availability of carcasses is not being increased. Among the entire group of respondents, the majority (74.6%) claimed that they never persecuted vultures, and 86.9% are aware that the vultures are beneficial creatures to human beings. Respondents of about 62.4 % disagreed with the use of chemical fertilizers and pesticides as one of the causes of vulture decline. It was interesting to note that 58 % of the respondents considered the increasing stray dog population as a menace. Most of the respondents agreed that deforestation and food scarcity may cause vulture decline. Among the respondents only (21.9%) of them were not aware of diclofenac and its cause for the catastrophic declines of the vulture population in MTR. It is quite interesting to note that most of the respondents (55.7%) agreed that Melaxicom is not a harmful drug to vultures and many of them (92.4%) also agreed to protect the vulture for future generations (Table 3).

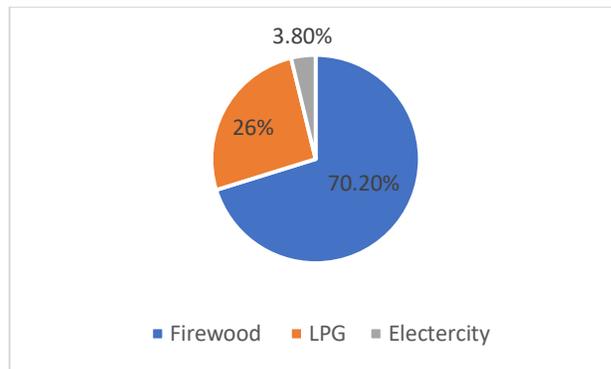


Figure no 1: Livelihood of respondents

Table no 2: Reason for loss of livestock

| Total number of live stockholder interviewed | Total number of livestock lost for the past five years | Reason for loss of livestock | | |
|--|--|------------------------------|---------|-----------------------|
| | | Natural | Disease | Wild animal predation |
| 81 | 243 | 86 | 90 | 67 |
| Average per year | 48.6 | 17.2 | 18 | 13.5 |

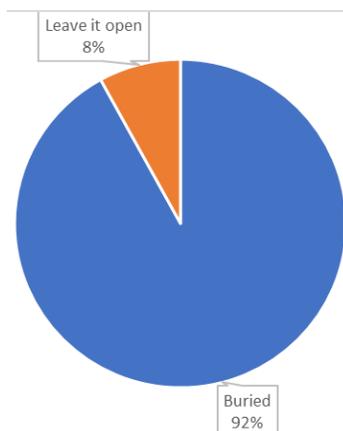


Figure no 2: Disposal of livestock carcasses by the livestock holders

The dichotomized scale was used to test the significant predictors of conservation attitude among the various respondents of MTR. Significantly, female respondents showed a positive attitude (90.58), toward vulture conservation compared to male respondents (47.18), (χ^2 76.192, $p < 0.001$). The Recently settler (77.42) had shown a favorable attitude towards vulture conservation than the other two categories of the first-generation and second-generation in the study area, No Significant difference towards First-generation, Second generation and recently Settled ($\chi^2=1.896, p=0.398$). The study also positively indicated that the younger generation was more (91.6%) in favor of vulture conservation than middle and old aged respondents viz. 10.67% and 12.24% respectively ($\chi^2=0.785, p=0.675$). Among the younger groups, significantly most (89.74%) of the respondents who had college education showed favorable attitudes towards vulture conservation compared to illiterate, primary, and secondary respondents ($\chi^2=35.824, p < 0.001$). Most (85.42%) of the livestock holders were shown a favorable attitude towards vulture conservation than others ($\chi^2=40.001, p < 0.001$) (Table 4).

Table no 3: The overall attitude of three-generation settlers of MTR towards vulture conservation

| Questions related to vulture conservation | Agree % | Disagree % | Neutral % |
|---|---------|------------|-----------|
| Are vultures declining in your location | 84 | 12.5 | 3.5 |
| Any mass mortality of vultures recorded in recent years in your area? | 34.1 | 50.1 | 15.1 |
| Are there more carcasses that had been seen than before in your area? | 23.6 | 74.1 | 2.3 |
| Do the local people kill vultures? | 14.9 | 74.6 | 10.5 |
| It is important to set aside a place for animals to live in | 86.9 | 10.5 | 2.6 |
| Is it important to educate the people on vulture conservation? | 72.9 | 19.8 | 7.3 |
| Should we conserve the vultures for future generations? | 92.4 | 5.2 | 2.3 |
| Do religious reasons play role in vulture conservation? | 54.5 | 33.2 | 12.2 |
| Are vultures are beneficial to humans? | 77 | 19.8 | 3.2 |
| Are the forests cover around your village is decreased in recent years? | 70.6 | 21.6 | 7.6 |
| May the chemical fertilizers and pesticides cause vulture decline? | 31.2 | 62.4 | 6.4 |
| Is the stray dog population have increased when compared to the past ten years ago? | 58 | 38.8 | 3.2 |
| Whether Diclofenac or ant veterinary medicines cause vulture death? | 75.5 | 21.9 | 2.6 |
| Melaxicom is not a harmful drug to vultures? | 55.7 | 40.5 | 3.8 |
| May deforestation/food scarcity cause vulture decline? | 96.2 | 2.6 | 1.2 |

Table no 4: The relation between socioeconomic factors and conservation attitudes of the local people on vulture conservation

| Factors | Category | UF (%) | F (%) | χ^2 | df | P |
|------------|-------------------|--------|-------|----------|----|--------|
| Gender | Male | 52.82 | 47.18 | 76.192 | 1 | .000** |
| | Female | 9.42 | 90.58 | | | |
| Generation | First Generation | 32.73 | 67.27 | 1.896 | 2 | 0.398 |
| | Second Generation | 25.41 | 74.42 | | | |
| | Recently Settled | 22.58 | 77.42 | | | |
| Age | 18-30 years | 8.24 | 91.76 | 0.785 | 2 | 0.675 |
| | 30-50 years | 10.67 | 89.33 | | | |
| | Above 50 years | 12.24 | 87.76 | | | |
| Caste | Tribe | 14.38 | 85.62 | 20.802 | 2 | .000** |

| | | | | | | |
|---------------------------|-------------------------|-------|-------|--------|---|--------|
| | Non-tribe | 36.76 | 63.24 | | | |
| Educational qualification | Illiterate | 46.73 | 53.27 | 35.824 | 3 | .000** |
| | Primary | 46.25 | 53.75 | | | |
| | Secondary | 17.76 | 82.24 | | | |
| | College level | 10.26 | 89.74 | | | |
| Livestock holder | Yes | 14.58 | 85.42 | 40.001 | 1 | .000** |
| | no | 36.49 | 63.51 | | | |
| Department | Electricity .Board (EB) | 46.30 | 53.70 | 17.948 | 1 | .000** |
| | Forest Department | 9.09 | 90.91 | | | |

** =P<0.001, * = P<0.05. UF= Unfavorable, F= Favorable, M = mean, χ^2 =Chisquare.

IV. Discussion

Personal attitude is the most important factor in determining people's intention towards supporting vulture conservation in MTR. Respondents who believe that the vulture should not be persecuted or killed for no reason, are more likely to support vulture conservation efforts in the study area. Further interrogation of this category of respondents revealed that their reasons were rooted in the belief that vultures are useful in their environment. The present study revealed that the awareness of vulture conservation was higher in second-generation settlers and recently settled people. The reason being the increase of awareness among the community due to the accessibility to primary and secondary education compared to the old generation who are illiterate and are generally unaware of the drastic decline of the vulture population elsewhere. Therefore this study suggests that education programs should be imparted among the first generation people along with others on the impact of vulture conservation. Most of the past studies have also emphasized the need for environmental education programs for such people to draw their attention towards conservation (Heinen 1998, Emtage 2004). The illiteracy rate among the non-ethnic groups was higher than ethnic groups. None of the respondents from disadvantaged groups (e.g., Tribal) had achieved college-level education. Socioeconomic status, as measured by education, represents a primary factor that affects the attitude towards vulture conservation. Data obtained in this study have revealed a highly positive attitude among those people who obtained higher secondary and college-level education. Further, this study has found a positive attitude among both the younger generation and females of all age group respondents. The young generation is well aware of the vulture decline as they had good access to education and modern gadgets and are aware of the benefits of the vulture to the ecosystem and human health. These results suggest that these demographic groups would be inclined to express a strong affection towards vultures' protection. Peoples from lower caste (Tribal) and livestock holders show high interest in vulture conservation. Besides, people who worked in TNEB (Tamilnadu electric board) station inside the MTR has a more favorable attitude towards vulture conservation.

Subsistence agriculture and livestock rearing are the mainstay occupation of people in the study area. Many households reared livestock with an average of about three individuals per household. The present study has recorded that the livestock was generally treated by professional veterinarians and they usually prescribed Meloxicam, Flunixin, and Nimesulide as pain relievers. Despite the ban on diclofenac from the country in 2008, informal discussions with veterinary personnel revealed that local people still prefer to use diclofenac with the belief that it is cheap and more effective than other NSAIDs. Besides, the illegal use of diclofenac for human purposes is considered to be a serious potential threat to vultures (Cuthbert et al. 2016). Nevertheless, recent research has found Nimesulide as another potential threat to vultures (Cuthbert et al. 2016). The present study found that approximately 90% of the livestock holders buried their carcasses. Vultures have become the victim of deliberate or unintentional poisoning of carcasses not only in the Mudumalai tiger reserve but many other regions. The number of domestic dogs in MTR has increased several-fold in numbers over a period of the last 5 years. This also has led to a lack of food availability for the vulture population.

People believed that the vultures are highly beneficial creatures to human societies because they do ecosystem services in making a clean and healthy environment by consuming carcasses. However, the people did not have any regard for vultures towards cultural grounds. People were aware of the dwindling of the vulture population in recent years due to mass mortality. A study conducted in the eastern mid-hills of Nepal also reported that the majority of the respondents showed a positive attitude towards vultures and a desire to support their conservation (Phuya et al., 2016) to improve environmental quality. Despite this seemingly widespread desire to

support vulture conservation, a small number of respondents in the current study expressed aversion towards the vulture and would want them annihilated from their communities. This category of respondents is not likely to support vulture conservation in their communities. An informal discussion with the respondents showed that they were quite negative with the vultures nesting in trees within their farmlands because they perceived vultures as a pest due to their smell from whitewash droppings. Hence, the attitude assessment and the related socio-economic factors lead to impart new methods of awareness by targeting the exact community in the area.

V. Conclusion

In MTR, During past decard many education programs on vulture conservation have been don by both governmental , non governmental efforts . Thise as made a pastive impact on the three gereneration respontents be have surveyed. The segregation of different determinants of intention and behavior may help to identify specific aspects of attitudes of individuals or societies that need to be manipulated to achieve success in conservation interventions. Mudumalai tiger reserve is harboring a wild and viable vulture population in Southern India. Significantly, the people who are living in and around the MTR are mostly illiterate and belong to both tribal and non-tribal communities. Since livestock is considered to be an important livelihood source for the local communities, it is of utmost importance to grant compensation to livestock holders immediately for the loss of their livestock killed by wild animals. This will help in winning the confidence of livestock holders against retaliatory killing and imparting a positive attitude on conservation in general. The carcass poisoning has killed vultures in this study area as part of retaliatory action by livestock holders on carnivores. The present study concluded that pharmaceuticals located in and around the vulture habitats need to be sensitized against dangerous drugs such as nimesulide, flunixin, and Ketoprofen. Strong and scientific awareness campaigns are frequently needed to local people, pilgrims, livestock holders, veterinarians, quacks, and drug stores for the long run conservation of vultures in this region. Education through awareness creation can help dispel misconceptions and engender positive attitudes towards the vulture as an important and specialized scavenger in humanized environments and thereby its conservation.

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