Habitat Use by Gaur (*Bos gaurus gaurus)* and Assessment of Human-Gaur Conflicts in Human Modified Landscapes of Nilgiris Forest Division, Tamil Nadu

Dissertation submitted to the

SAURASHTRA UNIVERSITY

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In partial fulfillment of Masters Degree in Wildlife Science

By

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Wildlife Institute of India

DECLARATION

I, **Indira S**. hereby declare that the research work entitled **"Habitat use of Gaur (*Bos gaurus gaurus)* and Assessment of Human-Gaur conflict in Human Modified Landscapes of Nilgiris Forest Division, Tamil Nadu", carried out** in partial fulfilment of M.Sc. (Wildlife Science) degree of Saurashtra University, Rajkot is an original piece of research work. This research work was carried out under the supervision of **Dr. S. Sathyakumar**, at the Wildlife Institute of India from December 2018 to June 2019. I hereby declare that this work has not been submitted for any other degree of any university.

Date: June 30, 2019
Place: Dehra Dun

Ms. Indira S
(XVI M.Sc. Course)

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Wildlife Institute of India

CERTIFICATE

This is to certify that Ms. Indira S. has carried out an original piece of research in partial fulfillment of Master's Degree in Wildlife Science of the Saurashtra University, Rajkot. The topic of her dissertation is **"Habitat use of Gaur and Assessment of Human-Gaur conflict in Human Modified Landscapes of Nilgiris Forest Division, Tamil Nadu".** The study was carried out under my supervision from December 2018 to June 2019. I hereby certify that this work has not been submitted for any degree to any university.

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"When you want something, all the universe conspires in helping you to achieve it"

- *Paulo Coelho*

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Summary

Gaur is the largest bovine in the world and is threatened by factors such as habitat loss, poaching, diseases and other anthropogenic stresses. In unprotected landscape, their habitat is confined to small forest pockets which are interspersed with human habitations. This study investigated the use of human-modified landscapes by gaur and how does this potentially increase the negative interaction between human and the animal. Information on ecology of gaur is limited to a few studies conducted within protected areas in India.

This study was conducted in the six ranges of the Nilgiris FD, *viz*., Udhagai North, Udhagai South, Kattabettu, Kotagiri, Coonoor, and Kundha that encompassed an area of 900 km^2 during the period January to April, 2019. Secondary data related to conflict and gaur mortality was collected from the District Forest Office to assess the current conflict scenario. To investigate the habitat use by gaur, the study area was divided into grids (2 km x 2km) and an average effort of 1.5 km (+/- 0.5 km) was made in every grid.To evaluate the perception and attitude of people towards gaur and human-gaur conflict, a semi-structured questionnaire was designed preceding the reconnaissance survey. The total crop raiding incidences were 31, human deaths 6, human injury 36, livestock death 4 and property damage 3. Injuries to humans due to gaur attacks appears to be most recorded conflict as indicated by the number of incidents in 3 years, followed by crop raiding, human deaths, livestock deaths and property damage. Areas such as Nunthala, Adhigaratti and Ithalar of Kundha and Udhagai south has high conflict. Areas such as Konvakarai and Bickapathy had medium conflicts and the rest were of low conflict intensity. Most of the conflicts were of crop raiding during the months January to April. In total, 79 gaur sightings 38 dung were recorded in the study area during the study period. Most of the visual sightings were in tea plantation followed by reserve forest, human settlement and cropland. Gaur dung were recorded only in forested habitats. Various groups of people majorly sight gaur in tea

plantations than other habitats. Most of the respondents have sighted gaur in and around human habitation during dawn followed by dusk and night hours. Crop Raiding (CR), Human Attack (HA), Traffic hindrance (TRA), Presence in Human Habitation (PRE HH) are the classes of conflicts perceived by the local communities. Majority of the respondents sighted gaur at least twice in a weak. Respondents' perceived gaur as threat majorly due to have experiencing fear of attack and crop raiding. Gaur is considered as a major threat animal followed by sloth bear, wild pig, leopard and bonnet macaque. Tea plantations are the source for grass and weeds for the gaur to feed on. Proportion of reserve forest is less than other land use classes in the study area. Hence, for the large mammal like gaur can sustain only if it adapts to use the human habitation for food. Investigations on body health condition, home range, population, breeding ecology, behavior, and so on should be made in the future to understand the ecology of the large bovid within close proximity to human. Such research findings will help to make better conservation efforts for site specific and species specific issue.

In spite of various wildlife encounters and conflict incidences it is likely that people and animals are co-existing in the Nilgiris. The Forest Department may have to adopt proactive measures for monitoring and management of human-animal conflict in the Nilgiris with more emphasis on gaur. Awareness creation amongst local communities and rapid response by the Forest Department personnel to manage human-wildlife conflict is crucial to avoid injury/ death and other losses/disturbances for the peaceful co-existence of both animal and people.

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1.0 Introduction:

Gaur (*Bos gaurus* C.H. Smith, 1827) is the largest bovine in the world. Globally three subspecies of Gaur have been recognised, *Bos gaurus gaurus* in India, *Bos gaurus readei* and *Bos gaurus hubbacki* in the Southeast Asian countries. Gaur is listed as Vulnerable in the IUCN Red list, listed in Appendix I of the CITES, and listed in Schedule I of the Wildlife (Protection Act), 1972. The global population is estimated to be between 15,000-35,000 animals (Duckworth et al, 2016). The population of gaur is declining in parts of its range especially in Indochina and Malaysia. In India and Nepal the overall decline is considerably low due to most of their population occurring in protected areas (Duckworth et al, 2016).

Gaur is threatened by factors such as habitat loss, poaching, diseases and other anthropogenic stresses (Choudhury, 2002). Information on ecology of gaur is limited to a few studies conducted within protected areas in India (Ashokkumar et al, 2010). This poses a challenge for developing conservation plans for gaur in human dominated landscapes (Joshi, 2017). Gaur is a megaherbivore, which has a large home range (Schaller, 1968). In unprotected landscapes, their habitat is confined to small forest pockets which are interspersed with human habitations. Animals using human habitations, increases the likelihood of human-animal interaction (Madhusudan and Mishra, 2003).

Increasing negative interactions between wild animals and human may lead to vulnerability of the animal to retaliation as well as people who may suffer loss of lives and economic loss (Suryawanshi, 2014). It is important to address the issue of Human-Wildlife conflict before it goes beyond the tolerance level of the people which will negatively impact the conservation of the species (Madhusudan and Mishra, 2003).

Persistence of wide-ranging mammals such as megaherbivore in fragmented landscapes requires extending conservation efforts in human modified landscapes that are away from protected areas (Kumar et al, 2010). Understanding how large mammals use such landscapes would help in preventing conflicts (Kumar et al, 2010)

This study investigatedthe use of human-modified landscapes by gaur and how does this potentially increase the negative interaction between human and the animal.

1.1 Literature review:

A brief review of the research carried out on gaurs is given below:

Information on natural history, distribution, behavior, and ecology of gaur have been presented by Gee (1964), Schaller (1967), Prater (1971) and Krishnan (1972).

Study on habitat use and movement patterns of Malayan gaur (*Bos gaurus hubacki*) has been carried out in Malaysia (Conary 1989), Srikosamatara and Suteethorn (1995), Duckworth and Hedges (1998), and Johnsingh (1998).

Information on distribution, ecology, status and conservation of gaur in north-eastern India have been reported by Choudhury (1987, 1992, 1993, 1994a-b, 1995, 1996a-c, 1997a-b, 1998a-d, 1999, 2000a-b, 2002). He reported that gaur populations are declining throughout its distribution due to threats such as habitat loss, poaching, diseases and anthropogenic pressures.

Balakrishnan and Easa (1986) studied the habitat preferences of large mammals in the Parambikulam Wildlife Santuary which showed that gaur preferred man-made teak (*Tectona grandis*) plantations over natural forests and grasslands.

Karanth and Sunquist (1995) studied the selection of prey by tigers in tropical forests of Nagarhole. Their investigation showed that tigers preferred gaur, particularly young, among all prey species.

Shukla and Khare (1998) studied food habits of wild ungulates including gaur and their competition with livestock in Pench Wildlife Reserve, Central India. They reported diet overlap between wild ungulates and livestock, and concluded that this may lead to degradation of wildlife habitat.

Areendran, G (2000) carried out an ecological study on gaurs in Pench Tiger Reserve.

Pasha *et. al* (2002) reported debarking of teak (*Tectona grandis*) by gaur during summer in a tropical dry deciduous habitat of Central India.

Ashokkumar*et.al* (2004) studied group size and age-sex composition of gaur in Mudumalai Tiger Reserve. They concluded that gaurs have larger group sizes than elephants. The group size depends on the forage biomass availability. They reported crop raiding by gaur in fragmented forest regions.

Habitat preference by gaur in summer was studied by Goswami (2007).

Chetri (2006) investigated diet of gaur using microhistological analysis of fecal samples in Parsa Wildlife Reserve, Nepal and reported that the diet of gaur consisted of diverse species of plants with grass (family: poaceae) forming the major proportion of diet.

Sahoo and Das (2010) assessed anthropogenic threats to gaur in Baisipalli Wildlife Sanctuary. They reported livestock grazing, poaching and contagious diseases to be the main threats to gaur.

Life history traits of captive gaur in southern India were investigated by Ahrestani et al (2010). This was the pioneer study to give a detailed report on life history traits.

Ahrestani and Prins (2011) presented methods to determine age and sex of gaur. They studied on captive gaurs in two zoos from India and United States of America. They opined that sexes can be distinguished based on difference between shape and size of horns. The age of the gaur can be estimated based on the amount of white seen in the horns.

Ramesh et al (2012) studied the group size and population structure of gaur and Asian elephant in deciduous habitat of Western Ghats, India. Their study showed that gaur group size changes over different seasons depending on the availability of food. They reported that gaur group has skewed sex ratio, where only two or three bulls are seen in a herd of more than 20 individuals. This may be a resultant of intra-male competition that are mostly prevalent in ungulate population leading to greater male mortality.

Sankar et al (2013) studied the habitat use, distribution and food habits of reintroduced population of gaur in Bandhavgarh National Park. They estimated the summer, monsoon and winter home ranges of the collared animals as 290 km^2, 137 km^2 and 155 km^2 respectively.

Allwin et al (2016) studied the prevalence of gastrointestinal parasites in gaur and domestic cattle. They reported that the overall prevalence of parasites were 70%, about 63.3% reported in gaur and 80% in cattle. They concluded that, parasitic prevalence survey is vital in monitoring the impact on the health and maintenance of gaur population.

AtulAravind Joshi (2017) studied the human-wildlife conflict with reference to Indian gaur in the Northern Western Ghats, India. He reported crop raiding by gaurs. Few other crop raiding reports have been reported by Ashokkumar (2004, 2011), Gad (2012), and Choudhury (2002).

Most of the studies on gaur have been carried out in the protected areas, mainly dealing with distribution, status and ecology of the species. With the exception of a few, there are no investigations on ecology of gaur in unprotected and human modified landscapes. Human-Gaur conflict is yet to be investigated in many parts of its distribution range and therefore, this study has attempted to fill the existing research gap.

1.2 Objectives:

- To assess the Human-Gaur conflicts in Nilgiris Forest Division (FD).
- To assess the habitat use by Gaurs in the Human modified landscapes of the Nilgiris FD.
- To study the perception and attitude of local people towards Gaur and Human-Gaur Conflict in Nilgiri FD.

2.0 The Study Area

The Nilgiris Forest Division (FD) entirely falls in the central part of the Western Ghats. The overall land cover matrix consists of natural forest fragments interspersed with agricultural land, plantations and concrete infrastructures. Natural vegetation types are tropical wet evergreen, tropical semi evergreen, tropical moist deciduous and Montane wet temperate forest (Champion and Seth, 1968). The elevation of the study area ranges from 1600-2600 m asl. The highest elevation is Doddabetta peak (2637m). According to the Indian censes of 2011, the human population density is 427/km^2. The important communities of the Nilgiris are Todas, Kota, Irula, Kurumba and Badaga. The region receives rain from both southwest and northeast monsoon. The average annual rainfall is 1951 mm. Upper Nilgiris is one of the sky island ecosystems that is home to endemism and a hotspot for evolution as it is unique from other vegetation types in the lowland. Some of the endemic flora and fauna that is present here are *Rhododendron nilagiricum, Strobilanthus kunthiana* (Neel kurinji), *Nilgiritragus hylocrius* (Nilgiri tahr), *Ficedula nigrorufa* (Black and rufous flycatcher), *Anthus nilghiriensis* (Nilgiri pipit) and others.

This study was conducted in the six ranges of the Nilgiris FD, *viz*., Udhagai North, Udhagai South, Kattabettu, Kotagiri, Coonoor, and Kundha that encompassed an area of 900 km^2 (Fig.1). The majority of the population depend on agriculture and tea plantations. Major crops are carrot, beetroot, cabbage, raddish and beans. The Upper Nilgiris underwent large-scale alterations in the late 1800s when British introduced tea plantations and other monocultures such as *Acacia, Eucalyptus, Pinus* and *Cupressus.* There was large influx of people settling for employment in the hill station. This put immense pressure on the sensitive flora and fauna of the region leaving them vulnerable to constant threats.

In the recent past, the gaurs have been frequently encountered in and around the human habitations. These encounters have often led to injuries or death of humans. Crop raiding and obstruction of traffic by gaur are other negative interactions seen in this area (media reports and DFO, personal communication). Such conflicts are of concern to the people and the Tamil Nadu Forest Department. Keeping the above in view, this study investigated the issue of Human-Gaur conflicts in Nilgiri FD from the context of both ecological and social factors.

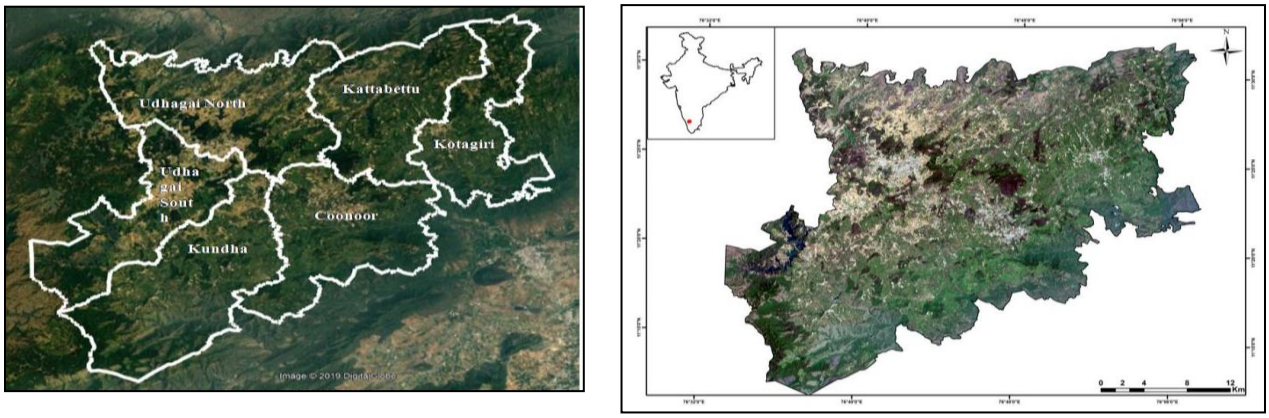

Figure 1. A map of the Study Area showing the six ranges of the Nigiris Forest Division

3.0 Methodology

3.1 Field methodology:

A reconnaissance survey was carried out during the month of December 2018 for delineation of the Study area. The Study area was delineated based on the following:

- The *ex gratia* / compensation records of the Nilgiri FD, that provided information on Human-Gaur conflict locations, conflict types, and their intensity (high, medium, low).
- Consultations with the DFO, Range officers and other front line staff.
- Participation in the Farmer's grievance meeting (crop loss due to wildlife) that is conducted every month in the District Collector office.
- Media reports were also collected to verify locations of conflict and the kind of conflict, to cross validate the reported conflict from the Forest Department.

This study was conducted in the six ranges of the Nilgiris FD, *viz*., Udhagai North, Udhagai South, Kattabettu, Kotagiri, Coonoor, and Kundha during the period January to April, 2019. To investigate the habitat use by gaur, the study area was divided into grids (2 km x 2km) and an average effort of 1.5 km (+/- 0.5 km) was made in every grid. While I tried to cover as much area as possible in the grid, some grids were not sampled due to logistic issues like inaccessibility and fire season. Locations of direct sightings with broad information such as habitat type, herd size, approximate age classes and behavior was noted as field observations. Fresh gaur dung signs were recorded as indirect evidences along the forest trail.

To evaluate the perception and attitude of people towards gaur and human-gaur conflict, a semi-structured questionnaire was designed preceding the reconnaissance survey. In total, 196 interviews were taken in my study area. Every beat in a range was considered as a unit. Average

area of a beat is 25 km^2 and within the beat I sampled all the major hamlets. At least 4 questionnaires were administered in one hamlet choosing random households. Every hamlet had a head and he was interviewed to get a general view of wildlife scenarios in the hamlet.

Oral consent was taken from every respondent before starting the interview. Questions were based on wildlife encounters, observation on gaur, kind of interaction with gaur, perceptions on conflict, and attitude on gaur. Questions were asked open ended and later the responses were fitted to the categories already made. The questionnaire used for the survey is provided in Appendix 1.

Analytical methods:

Four major habitat classes were identified in the field namely Agriculture +Tea plantations, Human Settlements, Water bodies and Reserved forests. Sentinel 2A satellite image of the study area was downloaded and used for the analysis. Using Erdas IMAGINE, 2016 unsupervised classes were generated. With the help of ground truthing points and Google earth PRO supervised classes for board habitat types were made.

Heat map for representing conflict hotspots were generated in ArcGIS version 10.8 using kernel density estimator. Maps with locations and grids overlaid on LULC were made through ArcGIS version 10.8.

The questionnaire surveys and other analysis were carried out in MS Excel 2007 and software R.

4.0 Results

4.1 Status of Human-Gaur conflict in Six ranges of the Nilgiris Forest Division

Five types of negative interactions (Human-Gaur conflict) were recorded by the Tamil Nadu Forest Department that made *ex gratia* / compensation payments for the years 2016, 2017 and 2019. Those conflict incidences were Crop Raiding, Human Death, Human Injury, Livestock Death and Property Damage. A total of 80 incidences were reported, out of which 20 from 2016, 34 from 2017, and 26 from 2018.

The Human-Gaur conflict locations points overlaid on the LULC map (Fig 2) shows that all types of conflicts have mostly occurred in the Agriculture areas that comprised of crop lands and tea plantations.

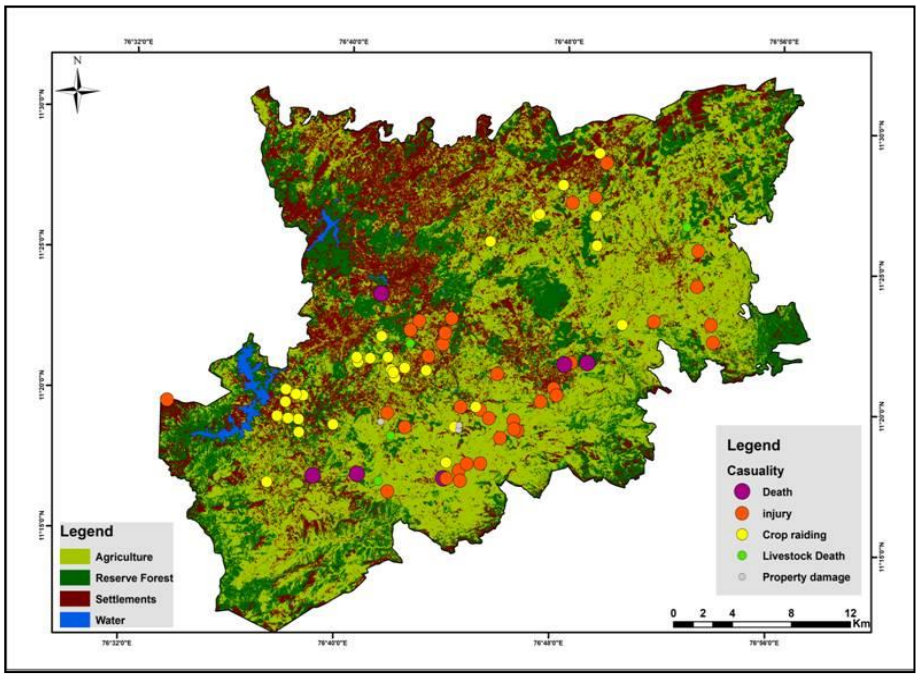

Figure 2. A Land Use Land Cover (LULC) map of the study area showing the locations of different types of Human-Gaur conflict cases (January 2016 to November 2018).

The total crop raiding incidences were 31, human deaths 6, human injury 36, livestock death 4 and property damage 3. Injuries to humans due to gaur attacks appears to be most recorded conflict as indicated by the number of incidents in 3 years, followed by crop raiding, human deaths, livestock deaths and property damage (Fig. 3).

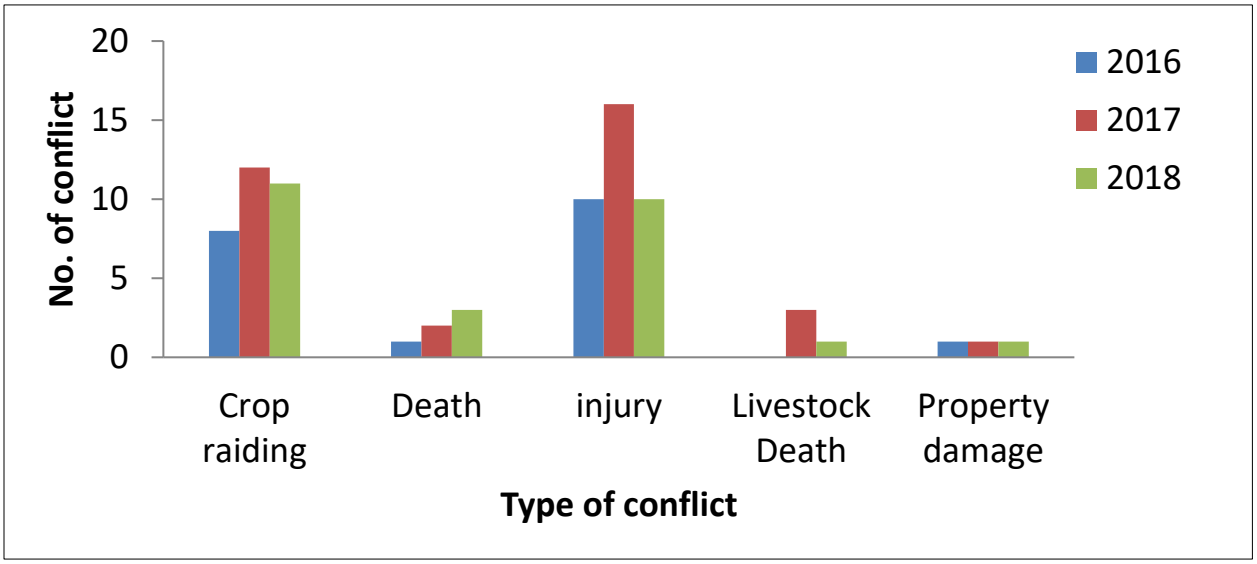

Figure 3. Human-Gaur conflict in Nilgiris Forest Division (2016 to 2018).

A heatmap was prepared showing high, medium, low intensity of reported conflict (Fig 4). Areas such as Nunthala, Adhigaratti and Ithalar of Kundha and Udhagai south has high conflict. Areas such as Konvakarai and Bickapathy had medium conflicts and the rest were of low conflict intensity. Most of the conflicts were of crop raiding during the months January to April.

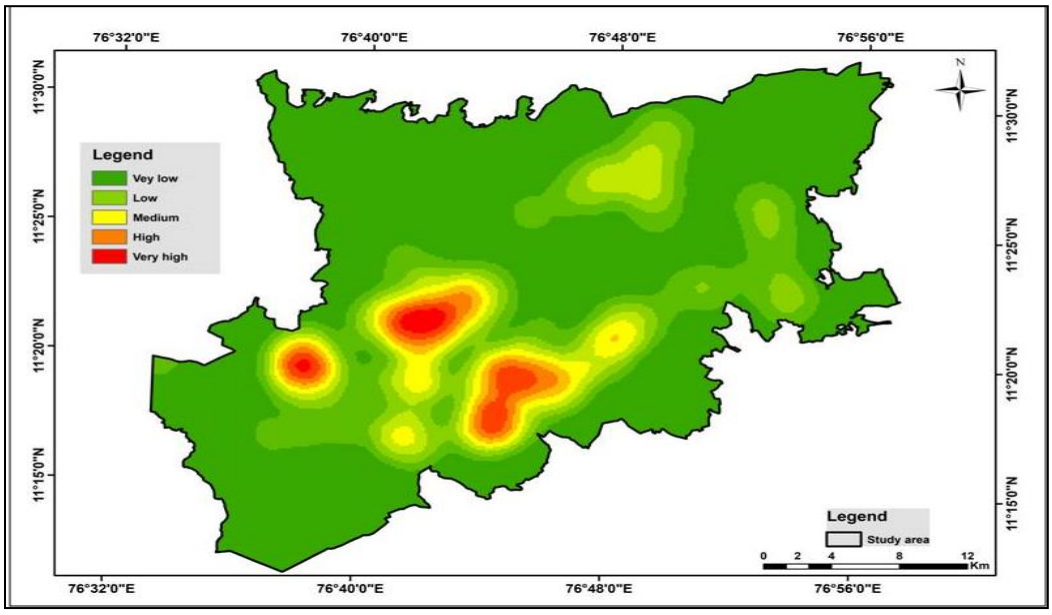

Figure 4. Heat map representing the locations of Human-Gaur conflict in Nilgiris Forest Division (2016 to 2018).

4.2 Habitat use by Gaurs in modified landscapes of the Nilgiris Forest Division.

In total, I had 79 visual sightings of gaur and 38 fresh dung in the study area during the study period. Of these, majorly gaur was sighted in tea plantation followed by reserve forest, human settlememt and cropland. Reserve forest includes both monocultures (*Acacia*, *Eucalyptus*, *Pinus*, *Cupressus*) and Shola forest. Gaur dung were recorded only in forested habitats (Fig 5).

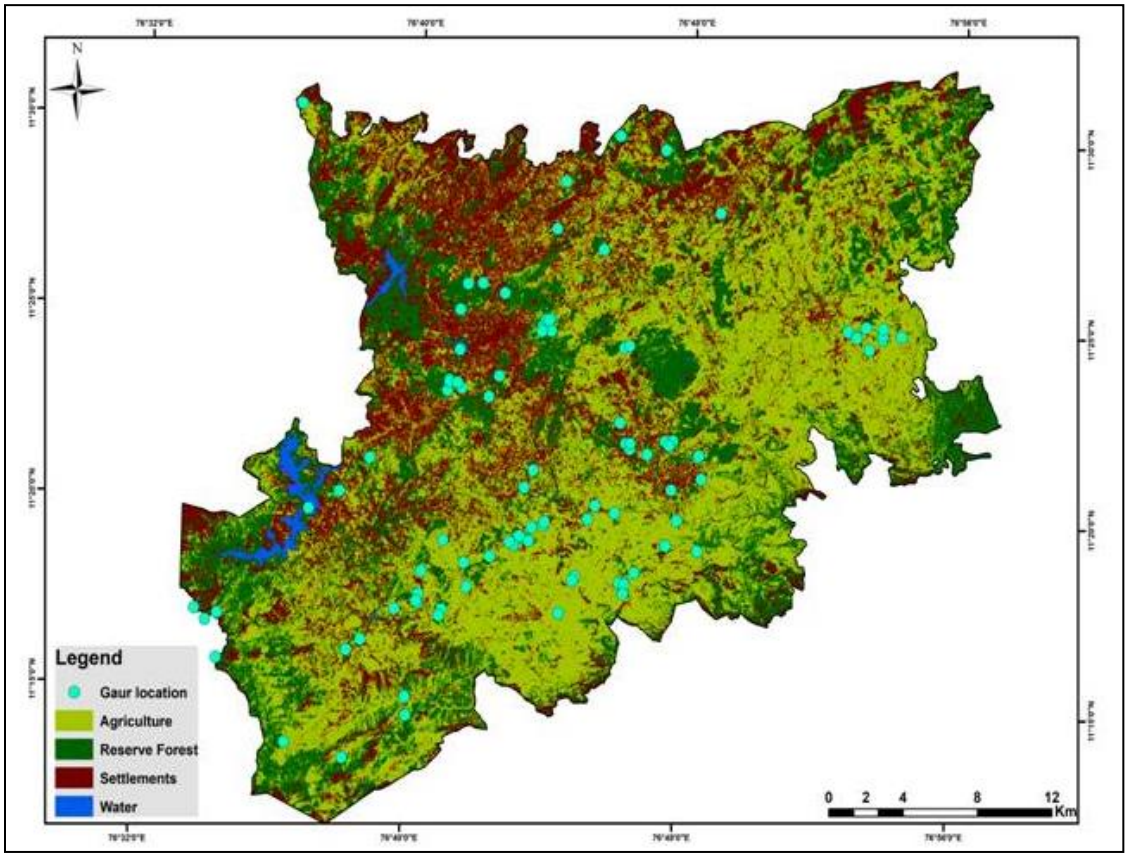

Figure 5. A map of the study area showing the gaur locations (January 2019 to April 2019)

Large number of visual encounters in agriculture and tea plantations has also been validated by the responses from people (Fig 6 & 7).

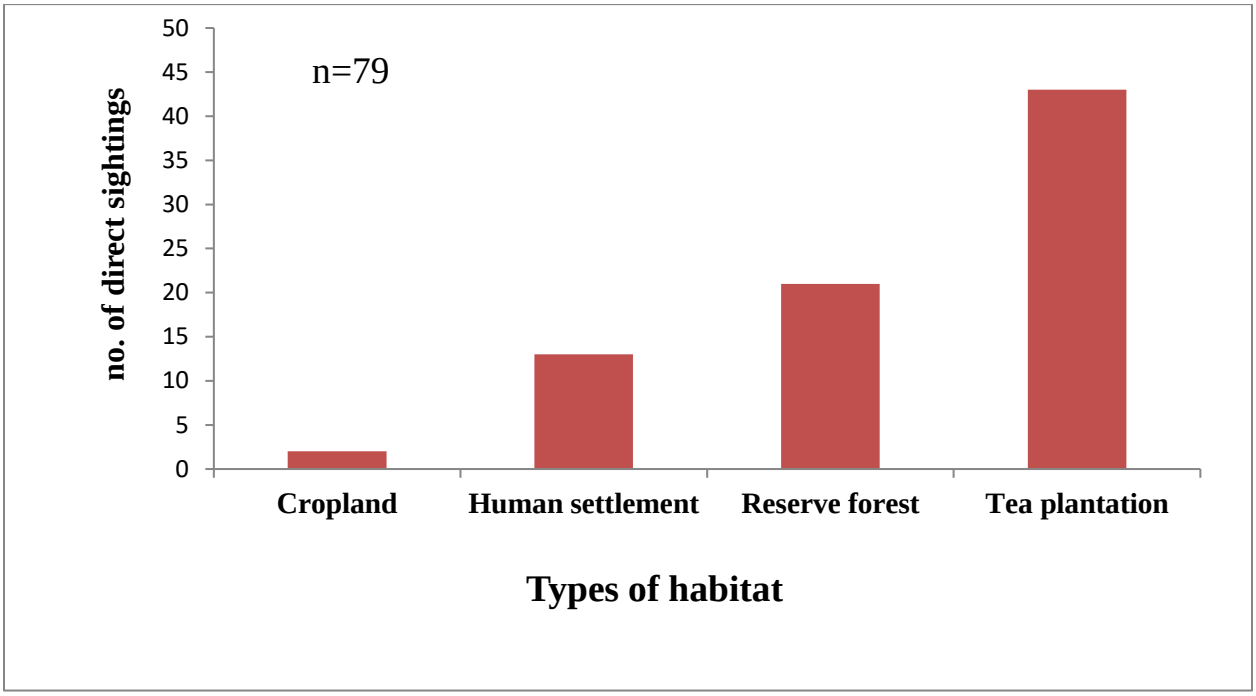

Figure 6. Visual encounters of gaur in the study area (December 2018 to April 2019)

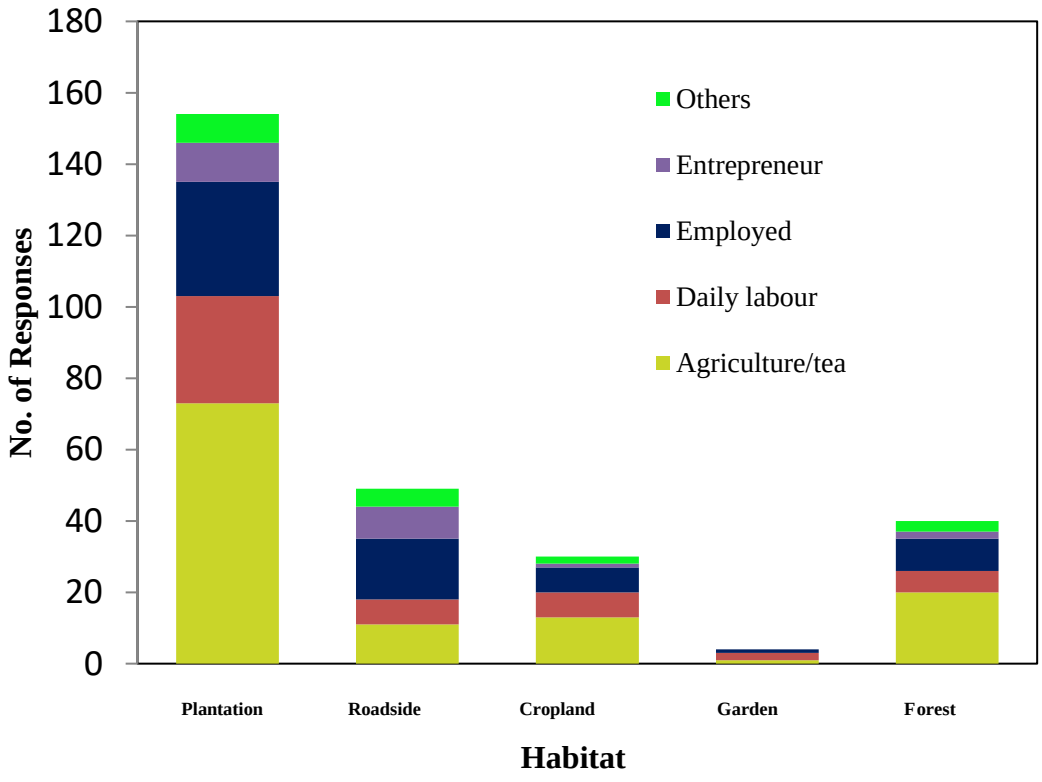

Figure 7. Visual encounters of gaur in the study area as reported by respondents

4.3 Perception and attitude of local people towards Gaur and Human-Gaur Conflict

Among 196 respondents interviewed for perception and attitude towards gaur, 144 were males and 52 were females. The average age of the respondent was 48, where the minimum age interviewed was 22 and the maximum age was 97. About 84% of respondents were literate and the rest were illiterate. The average size of the family was 4. Majority of the hamlets sampled for perception was well connected with road, had basic facilities such as primary health center and high school.

For questionnaire purpose, occupation was broadly classified into five categories namely Agriculture/Tea, Daily wage laborers, Business and others. Among the 196 respondents, 42% practiced agriculture or worked in tea gardens, 18% were daily labourers, 9% were entrepreneurs, 22% were employed (Govt./Private), 6% were unemployed, and the rest were others.

The landholding details of households who practice agriculture was ranging from 0.1 to 1 ha. All crops grown in the upper Nilgiris were commercial crops such as carrot, beetroot, beans, cabbage, potato, and radish. Three cropping seasons were practiced in one year, leaving the crop field fallow for at least 2 weeks after every harvest. Tea plantation work was also considered as agricultural practice by the respondents. Less than 1% of the respondents involved in secondary occupation that predominantly included agriculture. About 31 (1.6%) respondents owned livestock such as cow, buffalo, goat and poultry. The average cattle owned per household was three. Out of 31 respondents, 25 allowed their livestock to graze in open and rest stall fed. A very small proportion of respondents reported that they were dependent on reserve forest for fallen twigs and dry leaves to meet their fuelwood demand.

Over 97% among the respondents interviewed have sighted gaurs in and around their hamlet and majority of them sight gaurs at least twice a week (Fig. 8). Multiple responses were given by a single respondent for some of the questions asked. Hence, for every category of questions multiple responses were taken into account

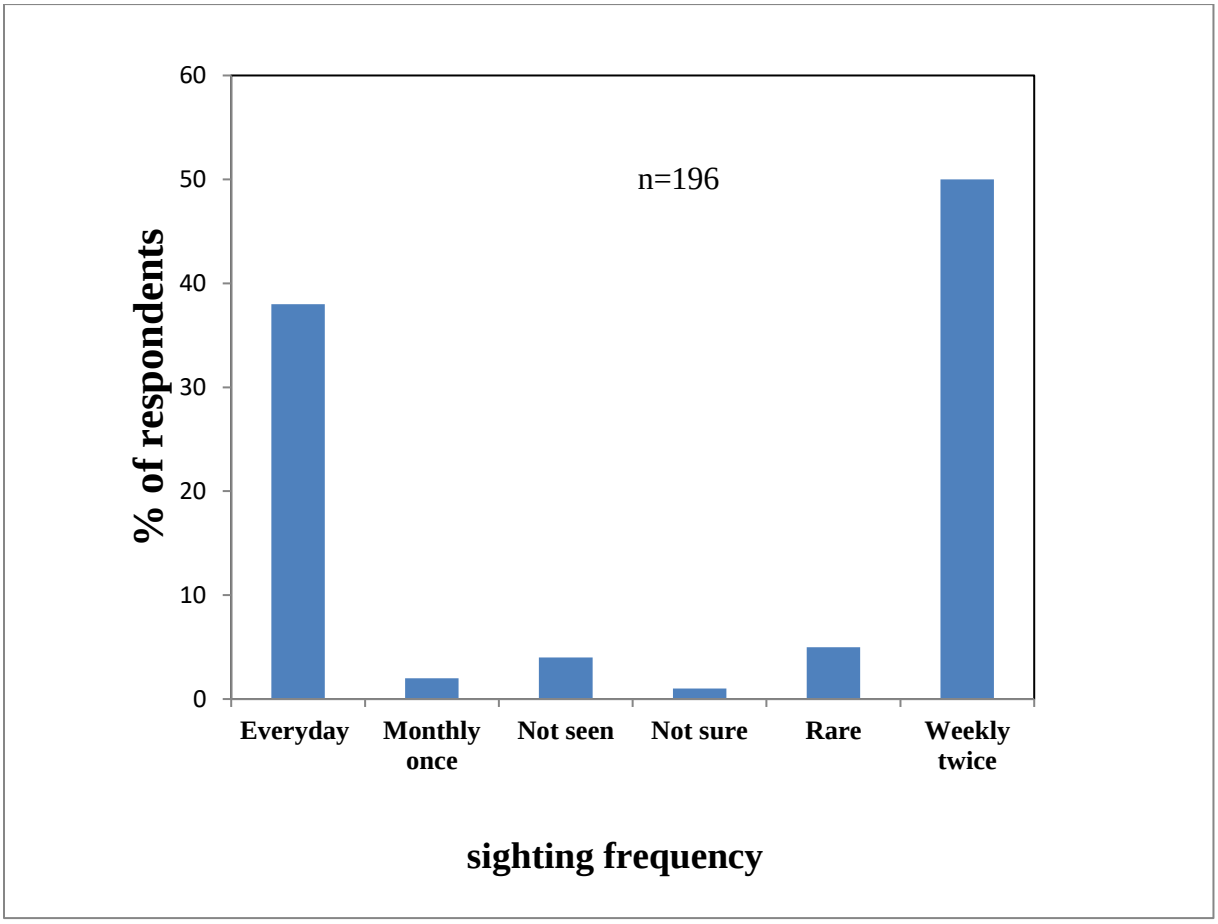

Figure 8. Sighting frequency of gaur in the study area as reported by respondents

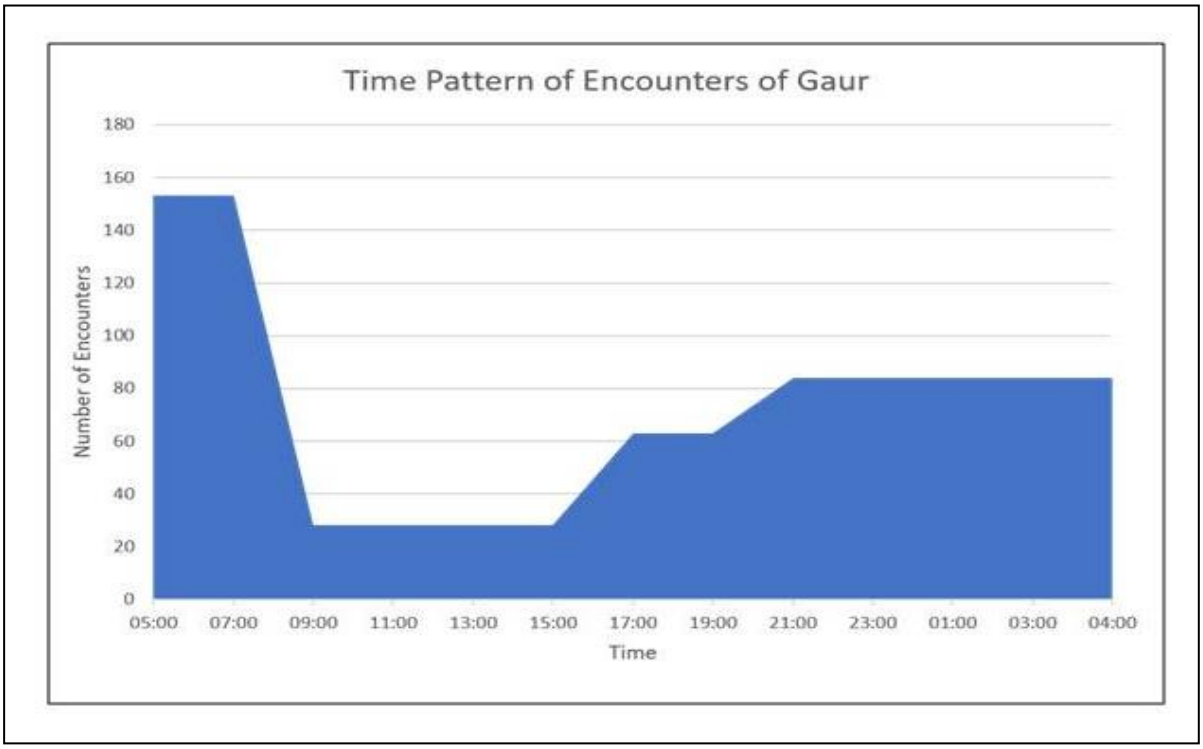

Figure 9. Temporal pattern of gaur encounters by respondents

Most of the respondents have sighted gaur in and around human habitation during dawn followed by dusk and night hours (Fig. 9). Crop Raiding (CR), Human Attack (HA), Traffic hindrance (TRA), Presence in Human Habitation (PRE HH) are the classes of conflicts perceived by the local communities. About 75% of the respondents were antagonistic to gaur based on negative interactions of others and knowing about conflict incidents through media reports. Only 13% of the respondents had experienced gaur conflicts.

Respondents had a negative perception of gaur. Over 88% of respondents perceived attack by gaur as a threat, 50% perceived crop raiding conflict, and 15% perceived Gaur as conflict animal when they were sighted in human habitation. About 2% respondents perceived traffic hindrance as conflict (Fig. 10).

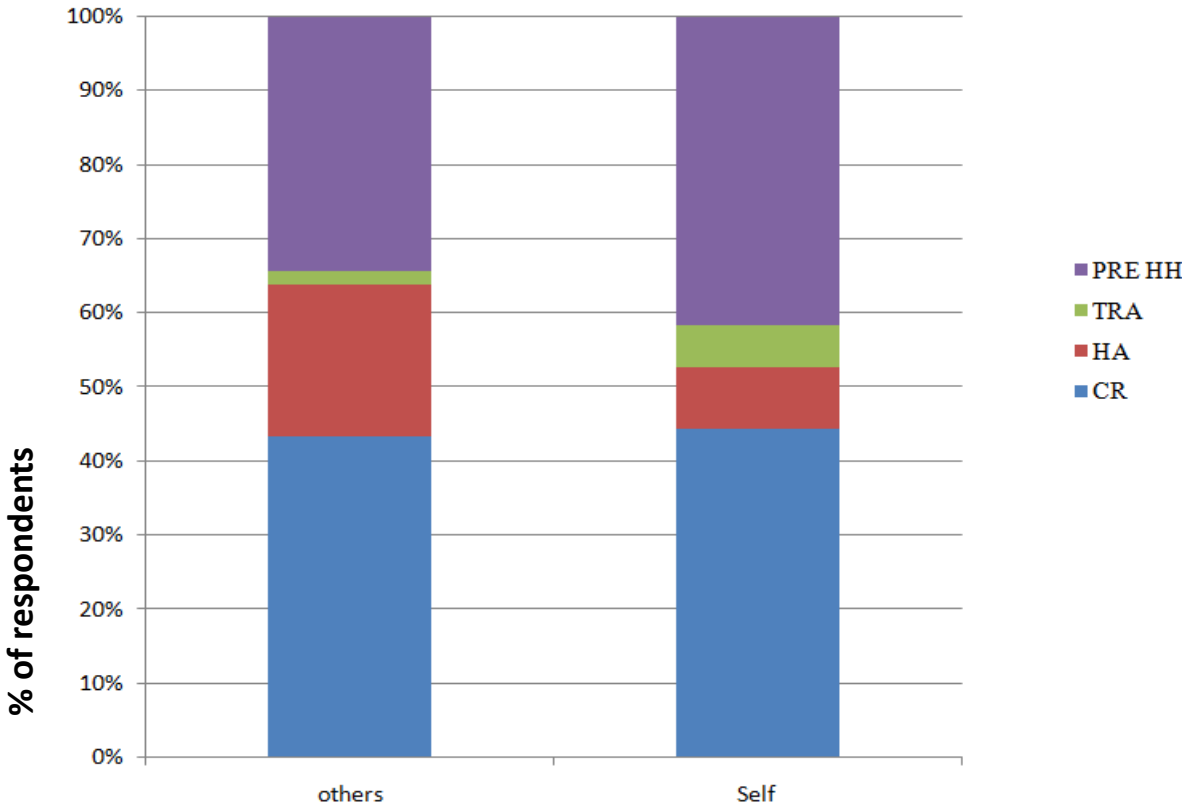

Figure 10. Human-Gaur Conflicts: Perception versus experience of the respondents

Conflict was perceived differently depending upon the wildlife species encountered around their hamlet. As multiple responses were reported by individual respondent for same species, we considered each type of conflicts for same species as independent and the responses for that conflict type is considered to be a proportion of total number of respondent.

According to the perceived report of conflict for different animals, the trend shows that Gaur is perceived to be the high conflicting species among other herbivores in terms of more responses for fear of attack and crop raiding. Among carnivores, sloth bear is perceived to be in high conflict in terms of more responses for fear of attack (Fig. 11).

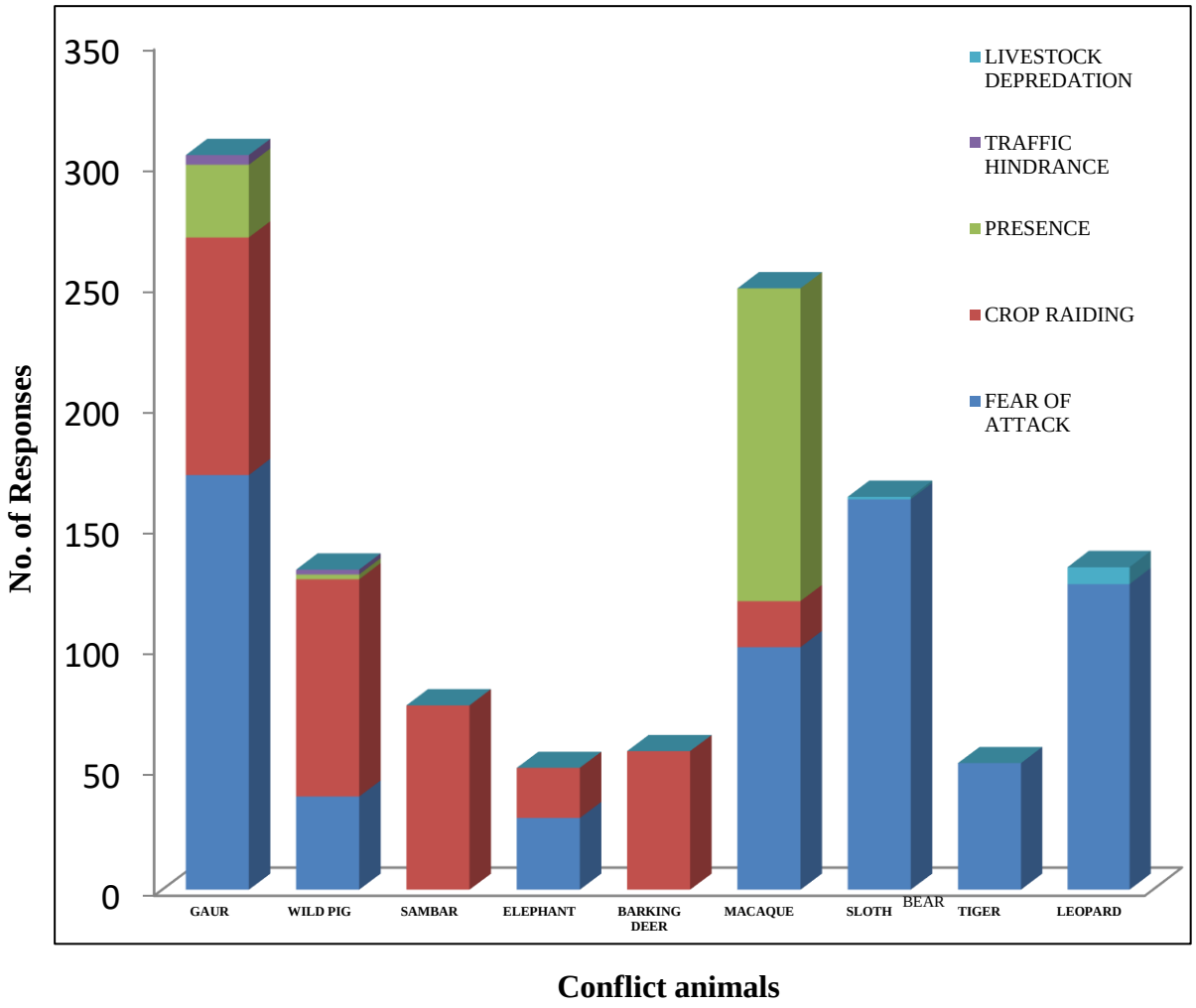

Figure 11. Wildlife Conflict Perception as reported by the Respondents

To evaluate animal threat perception among the respondents, ranks from 0-5 was given, where rank 5 indicates maximum threat and 0 indicates no threat. The response trend showed that Gaur was perceived to be more threat, followed by Sloth bear, Wild pig and Leopard as moderately threat among other wild animals seen in the region (Fig. 12).

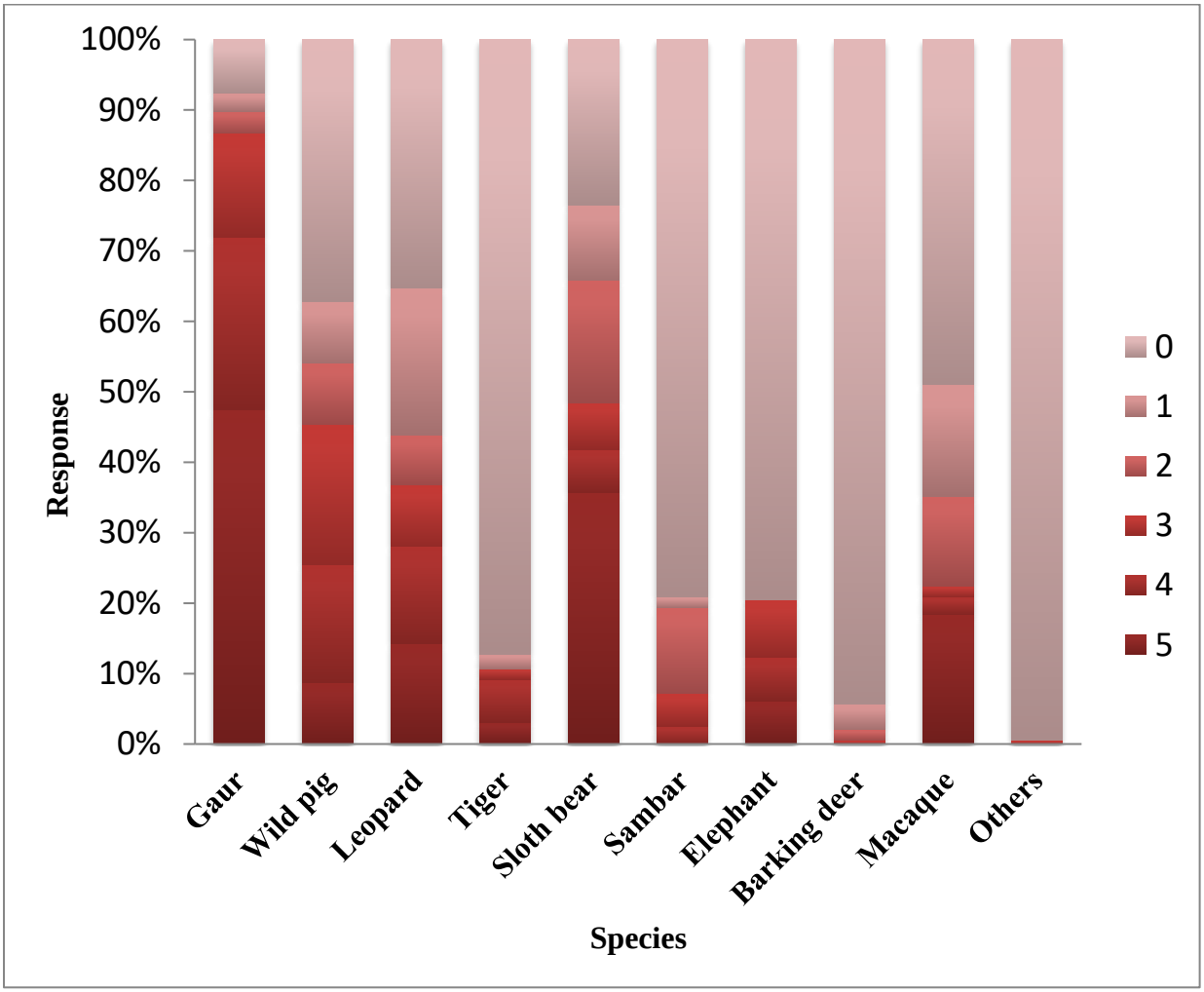

Figure 12. Response (%) and ranking (0-No conflict, 1-Very low, 2-Low, 3- Medium, 4-High, 5- Very high) of respondents towards different species

5.0 Discussion

About 15 to 20 years ago, the gaur was little known to the local communities of the Nilgiris. Currently, the scenario is such that most people sight a gaur almost on a daily basis, either solitary one walking brazenly in the middle of the road or grazing as a herd of 30-40 individuals in tea plantations. Local communities have wondered as to why many wildlife species are increasingly being encountered in and around human habitations. Encroachment and fragmentation of contiguous forests have paved out opportunities for the large ranging mammals and human to share the already jam packed space (Madhusudan and Mishra, 2003). Reserve forests in the upper Nilgiris or majority of my study area is a complex mosaic of montane wet evergreen forest (a locally common but globally unique Sholas) and monocultures such as *Acacia, Eucalyptus, Pinus* and *Cupressus*. These monocultures were introduced during the British colonial period to meet fuel wood demands and demands from tanning industries (Joshi, 2018). Post British colonial period, more of such exotic monoculture/s were brought from Australia, North America and Mexico. They were planted in the natural grasslands aimed to meet the future commercial benefits and also to forest the so called 'wasteland' grassland (Joshi, 2018). British introduced tea to Nilgiris and then the unknown hill station was opened to people migration from the lower areas for employment (Joshi, 2018). That is how a natural shola with few indigenous people became a limelight for a massive modification of landscape (Joshi, 2018). I strongly perceive that understanding history of a landscape is very important to interpret the current condition of a species (like population, behavior, Human-animal interaction, health condition, and so on). The monocultures are unpalatable for the animal as it contains high alkaloids. Moreover, there is hardly any undergrowth in the monocultures to feed any herbivores (Chabra, 2013). A large

mammal such as gaur predominantly being a grazer and polyphagous helps the animal to adapt any vegetation type (Ashokkumar et al, 2012). Hence this could be one of the possible reason for these huge bovids to move out into human habitation in search of food because the already existing few shola pockets will not be a sufficient option to fill their stomach. Agriculture / horticulture crops, food waste around villages, tourist spots (garbage sites) provide surplus and easy food sources for gaur. Forests and monoculture plantations are used by the animal to take refuge in the day time to avoid humans during the day.

Majority of the people said that they started to sight gaurs only since 5-10 years and they seem to have observed that the gaur population has increased since 2-5 years. That is when the reported conflict in Forest Department records started to increase (FD compensation records and personal communication with forest rangers). There is a steady increase in the number of human deaths by gaur since 2016. People who got gored are majorly daily laborers, age factor is also the reason to be more vulnerable to accidental attacks as it is difficult for them to flee away when an animal chases. There are increasing incidents of human injury since the last 3 years, this reason strongly shapes the perception of people. When enquiring to people about gaur attacks, it was surprising that 182 out of 196 respondents told that gaur attacks are accidental and not deliberate. It seems like people realize that gaur attack is inevitable when one is not careful enough to be cautious when sharing space with various wildlife. Even though people have high negative and threat perception towards gaur, most of them responded that lack of food/water and conversion of forests into concrete infrastructures are the main reason for the animal to encroach the human habitation.

In Coonoor range, there is a tourist spot called Sims park. In and around the park, there have been one human death and at least 5 injuries over the last 2 years. Close proximity to the park there are small fragments of reserve forests dominated with Acacia and Eucalyptus with some scattered shola plants within the monoculture. Gaurs take refuge inside these small scattered reserve forests during the day. During dawn and dusk, they come out and graze in the nearby tea plantation where accidents happen. Every morning, the front line staff of the Forest Department chase the gaur herds back to the forest in order to prevent any more casualty, as it is one of prime area for tourists. This work of frontline staff becomes counterintuitive when coming to addressing crop raiding cases in many villages. People from many villages are not aware of compensation scheme and they simply bare the loss to the animal. Lack of adequate man power in the Forest Department is a drawback for management of Human-wildlife conflict in the study area.

Tea plantations are the source for grass and weeds for the gaur to feed on. I sighted gaur feeding on tea and Acacia leaves at multiple occasions in the field. Further, long term monitoring is required to understand if really gaur has modified its behavior to feed on unpalatable exotic plants for survival. Investigations on body health condition, home range, population, breeding ecology, behavior, and so on should be made in the future to understand the ecology of the large bovid within close proximity to human. Such research findings will help to make better conservation efforts for site specific and species specific issue.

In spite of various wildlife encounters and conflict incidences it is likely that people and animals are co-existing in the Nilgiris. The Forest Department may have to adopt proactive measures for monitoring and management of human-animal conflict in the Nilgiris with more emphasis on gaur. Awareness creation amongst local communities and rapid response by the

Forest Department personnel to manage human-wildlife conflict is crucial to avoid injury/ death and other losses/disturbances for the peaceful co-existence of both animal and people.

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Appendix 1

ASSESSING HUMAN-GAUR INTERACTIONS IN THE SHARED LANDSCAPE OF THE UPPER NILGIRIS

Date:	**Place/Village:**
Beat:	**GPS Location:**
Name of the interviewer:	**Name of the respondent:**

Section1: Demography (includes visual assessment also)

- No of members in family/age/gender/dependent/education (>10 class, >12 class, degree, not educated)

Members in a family	Age	Gender	Education	Earn/dependent

- Religion and caste:
- Language spoken:
- Local or migrated:
- If migrated, since how many years you live in the region:

Section 2: Economic status (includes the visual assessment also)

- **Primary occupation:**

Occupation	Income
Agriculture	
Daily labor	
Government employee	
Private employee	
Others (specify)	

- **Secondary occupation:**

Occupation	Income
Agriculture	
Daily labor	
Government employee	
Private employee	
Others (specify)	

- If agriculture is one of the occupation/ primary occupation what are the major crops cultivated (per unit area productivity)

Major crops	No. of harvest/yr	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec

- Do you own livestock?
  Yes **No**
- What are the livestock and how many do you own?

Livestock	Number	Stall Fed	Grazed (specify where they are grazed)
Cow			
Buffalo			
Goat/sheep			
Poultry			

- Do you dependent on Reserve Forest?
  Yes **No**
  If yes what do you collect from forest?

For Fuel eg: dried leaves, fallen twigs.	
Fruits	
Tuber	
Others	

Section 3: Assessment of Human-Gaur Interaction

- Have you sighted gaur/Indian bison around human habitation?
  Yes **No**

- If**Yes**, how often do you sight and when:
  (Frequency, Day/Night/Crepuscular) Frequency (Everyday, weekly once, monthly once, seasonal, others) Day (8-10, 10-12, 12-4,) Night (>7PM) Crepuscular (dawn and dusk)

Frequency	Day	Night	Crepuscular

- What behavior of gaur have you observed when you sight them in Human habitation

W	G	R	S	S&M	O

[Walking, **G**razing, **R**unning, **S**itting, **S**itting and **M**astication, **Ot**her **B**ehavior]

- What social group of gaur you sight often

family group	solitary male	All male group

- Which social group do you think causes major conflict

family group	solitary male	All male group

- Have you come across incidences of antagonistic interaction with gaur?

Yes **No**

CR	HA	TRA	PRE HH	O

[**C**rop **R**aiding, **H**uman **A**ttack, **Tra**ffic hindrance, **P**resence in **H**uman **H**abitation, **O**thers]

- When was the last time you observe any antagonistic behavior of gaur? Does it happen to you or someone else (specify the incident and location).

Notes……
…….

- What are the wild animals that are involved in conflict in NFD and score their impact (1 is least and 5 is maximum impact)

Animal	Kind of Conflict	Score
Indian Gaur		
Wild Pig		
Leopard		
Tiger		
Sloth bear		
Sambar		
Others		

- Do you report the loss (Crop raiding, Human casualty, Traffic, etc.,) caused by Gaur to the Forest Department?

Yes **No**

- Did you get compensation to the reported conflict?

Yes **No**

Conflict	Compensation
Crop raiding	
Human attack	
Loss of life	
Others	

- Are you aware of any prevention/mitigation measures implemented by Forest Department to manage the conflict?

Yes **No**

- If yes, then what are the mitigation measures taken?

Notes……
……

- Do you practice any precautionary measures to avoid any negative interaction with gaurs?

Yes **No**

- If yes, then what are those measures?

Notes……
……

Section 4: Perception about Gaur

- What is your attitude towards Gaur

Like	Indifferent	Dislike	Do not know

- Since when you started to sight Gaur more in human habitations?
  (a) Since 5 years
  (b) Since 10 years
  (c) Since 15 years
  (d) Gaur was always sighted out in human habitation
- Do you know what is the role of Gaur in the wild?

- Do you think Gaur is beneficial to human?

- How is it like staying with wildlife? Statement.

- Why do you think Gaur has changed its behavior and come to human habitation?
  (a) Increase in Gaur Population
  (b) Conversion of Forests into Plantations, Agriculture and Housing
  (c) Lack of predators (Eg: Tiger, Leopard)/increase in predators
  (d) Lack of availability of food for Gaur in forests
  (e) Presence of cattles
  (f) Others
- Do you think Gaur attack is accidental?
  Yes **No**
- Do you think Gaur causes more threat to your life than other wild animals
  Yes **No**
  If No mention the other animals that you consider threat to life.

- According to you which kind of conflict occurs often and needs immediate attention:

CR	**HA**	**TRA**	**PRE HH**	**O**

[**C**rop **R**aiding, **H**uman **A**ttack, **Tra**ffic hindrance, **P**resence in **H**uman **H**abitation, **O**thers]

- In case of Human attack, who do you think are attacked very often and why
  (a) Men
  (b) Women
  (c) Children
  (d) Elderly people
  (e) Tourists
  (f) others
- Who do you think is responsible to control the current conflict scenario
  (a) Forest department
  (b) Local politician
  (c) People
  (d) NGO
  (e) Others
- Regarding the conflict caused by Gaur what would you suggest for solving the problem?
  (a) Using effective preventive methods/ strategies (Electric Fencing of agricultural field, to avoid getting out in the night, etc.,)
  (b) Killing the problem animal
  (c) Translocation of problem animal
  (d) Restoring the Gaur habitat
  (e) Do not know

(f) No solution
(g) Others