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# Nowhere to Live: Squeezing Habitat and Human-leopard Conflicts in Maligaon, Guwahati, Assam

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**Abstract** Guwahati, a city of 2 million residents is the largest city in northeastern part of India. Situated by the side of River Brahmaputra, the city is of an undulated topography with some hillocks and wetlands. The considerable area of the city is still forested and seven reserve forests are located within the city. The forested topography of the city offers a good habitat for the Common Indian Leopard (*Panthera pardus fusca*), a Scheduled I species under Indian Wildlife (Protection) Act 1972. Over the years, there have been growing casualties on human-leopard conflicts in the region. Indian common leopard (*Panthera pardus fusca*), is a highly adaptive species and do inhabit in human proximity, which creates conflicts resulting in a loss on both sides. The present study has found that there is a rise in the incidence of human-leopard conflict in Maligaon Gaushala farmland, located in 26°08'48.5"N and 91°41'39.2"E, covering land areas of 34.82 Hectare. The study has been conducted in this area from the last five years i.e. 2015-2019 and recorded 16 number of human-leopard conflicts. It is also found that the area is used for feeding and breeding ground of cattle, for keeping old unproductive cows and dumping ground for dead cattle's carcass. The area is covered with thick elephant grasses (*Pennisetum purpureum*), and it is used as chief fodder for cows inside the Gaushala farmland, which is a good foraging for high yielding of milk production from Gaushala farmland and optimum hiding ground for leopard. Due to expansion and high escalations of encroachment to the habitat of leopard a total of 90 incidences of human-leopard conflicts occurs since 1995, which include 13 human casualties, 3 leopards' mortality and 29 livestock predation. The present study investigates detail movements of the species, their habitat based on camera trapping, Scat analysis, GPS records and field interviews. The data thus gathered not only helped to record the nature of conflicts in the area but also to design a conservation plan for the species. The suggestions recorded in the study are intended to reduce the incidences human-leopard conflicts in the area.

**Keywords:** Indian common leopard, human-leopard conflicts, camera trapping, urban wildlife, Guwahati

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## 1. Introduction

*Panthera pardus fusca*, a Scheduled I species under Indian Wildlife (Protection) Act 1972, is found in two wildlife sanctuaries and seven reserve forests and its peripheral areas of Kamrup Metropolitan District, Assam, India. It is observed in the last few years that the depredations and casualties on human-leopard conflict in the region are increasing. The ever-increasing urban space, encroachment to forest areas and deforestation have created severe tussle for space between leopard and man. The result of this conflict is always brutal on the part of wildlife. Compared to the wildlife of protected

areas, the wildlife habitat in urban areas are prone to anthropogenic activities even though it is protected. To understand the plight of urban wildlife, more specifically leopard as in the present case, need to be delved in to mitigate the conflict to the extent possible. This paper aims to study and record the status of the common leopard present in and around Maligaon Gaushala farmland, Guwahati and human-leopard conflict for proper mitigation steps.

Indian Common Leopard (*Panthera pardus fusca*) considered being Near Threatened by IUCN (IUCN 2011) and being offered the highest level of protection under the provision of Indian Wildlife (Protection) Act 1972 as a Scheduled I species. This elusive, yet highly adaptive species do inhabit in human proximity, which sometimes

leads conflicts resulting in losses on both sides. The conflict shows an increasing trend within Guwahati for past few years, especially in areas like Silpukhuri, Loko-Colony, Kamakhya-Colony, LRS abandoned sites, (Siva-Temple site-LRS), DS Railway Colony, Pandu-port, Temple-Ghat-Pandu; Belsiri, Natunbasti-Boragaon; Kalapani, Lalungaon-Lokhra; Saraswati Nagar-Dhirenpara, East-Gotanagar-Bezbaruahnagar, (Sankardeb Nagar hilltop) Ambikagiri hill-Central Gotanagar Maligaon, (Mithaamtal, Gotanagar, Bishnurabha Nagar, Bhaskarnagar, Debkota Nagar, Segunbari, Saalbari, Natunbasti (Saalbari)-Madhabdeb Nagar hills, Garchuk-West Gotanagar Maligaon, Maligaon Gaushala Campus, (Doymogiri-Garo-basti)-Fatasil Aambari, Durga-Sarobar, Mathura Nagar-Santipur-Adingiri hills, (Bhaskar Nagar, Manpara)-Fatasil, Nilachal hills, 4th.Assam Police Battalion Camp, 10th.Assam Police Battalion Camp, Pasupatinagar, Birubari, Rupnagar, Kahilipara-(Colony Bazar), Sonaighuli, Krishnanagar, Deaf & Dumb School-(Kahilipara), Ulubari, Lokobandhu Nagar-Narakashur hills and Odalbakra, Kotahbari, (3 no. Mazidgali)-Kalapahar hills etc. This increasing conflict can be attributed to increasing human population in the metro, with decreasing habitat and natural prey base. Both human and wildlife suffer tangible consequences and the different stakeholders involved should commit themselves to tackle and resolve such conflicts in the future. Due to increasing human pressure in the fringes of the forests as well as straying leopards in the human habitation in search for livestock as easy prey, conflicts are often unavoidable. Leopards can live near humans with low levels of conflict [1,2] and this has also been seen in India [3].

The present severity of the problem demands preparation of immediate action plan for mitigation of Leopard-human conflict as well as conservation of existing leopards through population management. This required first-hand information on identification of areas with leopard presence, estimating abundance and mapping areas in terms of the severity of conflicts. However, population monitoring of large carnivores are difficult to conduct because are often elusive, secretive and nocturnal and roam over large distances [4]. Human-wildlife conflict (HWC) is fast becoming a critical threat to the survival of many globally endangered species, in particular to large and rare mammals such as the Sumatran tiger (*Panthera tigris sumatrae*) and the Asian lion (*Panthera leopercica*), but also less endangered species such as the snow leopard (*Uncia uncia*) and the Red colobus monkey (*Procolobus kirkii*). The numerous cases [5,6,7] from countries all over the world demonstrate the severity of the human-wildlife conflict and suggest that (IUCN - World Conservation Union - Red List of Threatened Species, 2003) an in depth analysis is essential to understand the problem and support the conservation prospects of threatened and potentially endangered species.

It is a daunting challenge to ensure the peaceful coexistence of leopards among high densities of humans of the order of 200 or more to a sq.km. Carnivore

density is known to be dependent on prey density [8,9]. Research indicates that even in such high human density areas, attacks on humans and domestic animals in most cases can be kept to very low levels. The goodwill and trust of people are vital to dealing with crisis situations arising out of loss of life and livestock by leopards. This paper provides a framework not only to address the conflict after its occurrence, but also to minimize such conflicts through adoption of necessary pro-active measures.

The overall goal of this study is to estimate the abundance of common leopards as well as understand the driving factors of leopard-human conflict in Maligaon Gaushala Farmland, Guwahati (Assam) and its adjoining hillocks. The present paper attempts to determine the estimates of human-leopard conflicts in the Maligaon Gaushala farm land including its adjoining hillocks and its impact on urban wildlife. Land use land cover maps supported by field data has been used extensively to generate a spatio-temporal vulnerability map which will be used as a benchmark for future wildlife conservation and planning of the region.

The main purpose of this research work is to assess the current state of the leopard conservation in Assam with special reference to urban landscape. This will involve monitoring the status of leopard-human conflict and establishing the current distribution range both within and outside the protected area network. The current distribution range of the leopard has been mapped and compared to data from the 1990's to quantify the shrinkage in leopard habitat over recent years. The leopard is one of the most adaptable and widely distributed species but although it is resilient in the face of human pressure it has suffered a decline in its population over the last decade [10]. To make matters worse, farmers and illegal hunters also kill leopards - 150 leopards were killed in Assam due to conflict. This research aims to encourage local communities to develop and refine their traditional means of mitigating human-leopard conflict by using non-invasive techniques.

## 2. Study Area

Government of India including State Government in joint collaboration with some NGO's and local business communities of the cities gave birth to the concept of "Gaushala" which were established in order to protect those cows that were destined to be slaughtered. Maligaon Gaushala farmland was established on 23 February, 1973, with perimeters 26°08'48.5" Northings and 91°41'39.2" Eastings covering land areas of 171 hectares situated in the West Gotanagar, Maligaon, Guwahati. In February, 1973, M/s Lalchand Kaniram Choudhury of Kolkata donated 171 hectares of land situated at Maligaon for growing grass for the cows and to keep invalid cows in the said complex respectively. The Maligaon Gaushala is selected to study the leopard behaviour in detail.

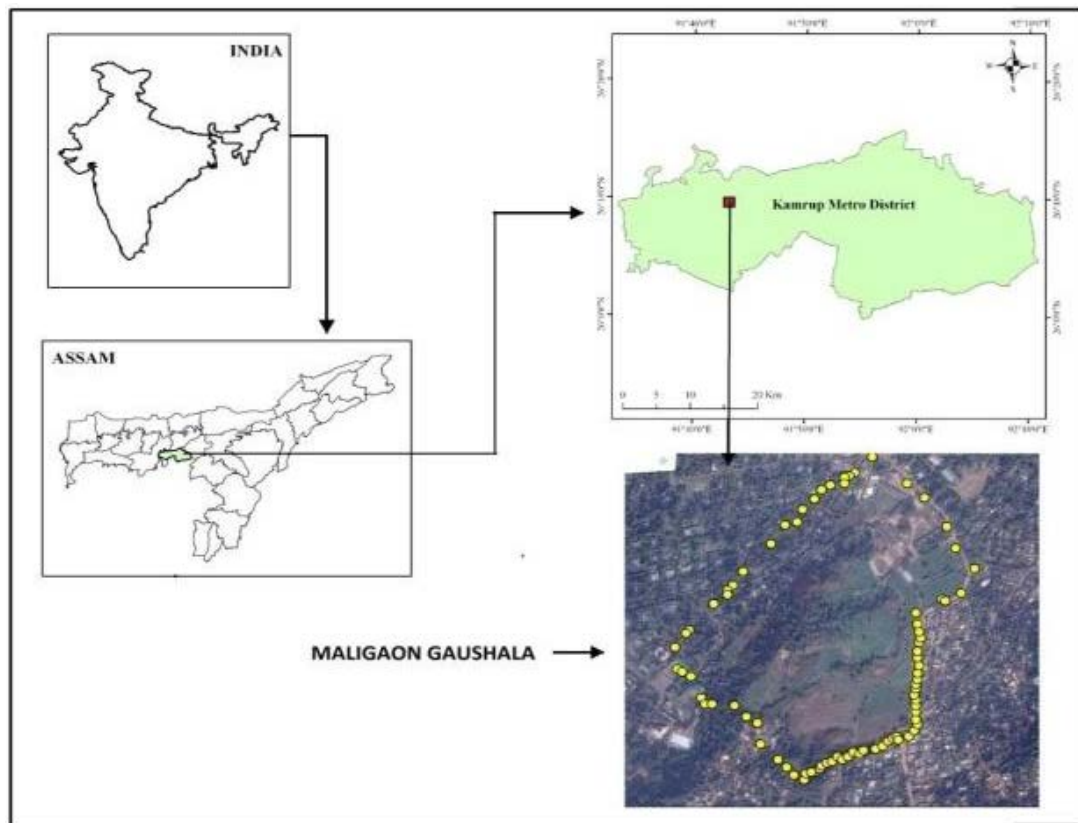


Figure 1. Location of the study area

### 3. Material and Methods

The study had been conducted in this area from the last five years i.e. 2015-2019. The study includes the identification of conflict zones through questionnaires and interviews of the people in and around the study sites, reports from media and stakeholders, and field survey to find out the ground reality. GPS points were recorded to mark the conflict site. Pug marks were casted in plaster of perish and stored in the University of Science & Technology Museum, Meghalaya.

Identification of the conflict level zones within the urban landscapes of Greater Guwahati, Assam through Questionnaire and GPS survey as primary sources of information, creation of the database from stake holders as secondary sources, and to use this information in developing a capture-mark-recapture sampling strategy.

Stratification of area of study was conducted on the basis of leopard sighted information and unsupervised habitat classification in GIS environment. Leopard presence was first accessed through review of media reports sighting and leopard-human conflict during 1998-2017.

Identification of the conflict level zones within the study area and use this information in developing a non invasive sampling strategy for population estimation [11,12,13] and scat analysis for prey.

#### 3.1. Camera Trapping for Population Estimation and Recognition of Species

The camera have been used intensively to capture images of that crucial killing sites whether inside home or outside in grazing area and will be used in future.

#### 3.2. Identification and Status of Indian Leopard (*Panthera Pardus Fusca*)

Identification of the species concern follows Pocock [14,15]. The status of species concern is based on the IUCN database ([www.iucn.org](http://www.iucn.org)) and Catalog of life ([www.catalogoflife.org](http://www.catalogoflife.org)).

#### 3.3. Collection of Primary Data

The interview schedules have been prepared for the collection of primary data. The primary target groups for collection of information are the people in and around the study area and recording of leopard-human conflict incidences, livestock depredations due to leopard. The requisites for collection of primary data include the followings.

#### 3.4. Questionnaire Survey

Keeping in view the objectives of the study, questionnaire is being prepared through consultation with supervisors and other key informants and researchers. The questionnaires have been pre-tested to avoid duplicate responses as much as possible. Two Questionnaires are prepared. Questionnaire 1 is for carnivore sign survey and Questionnaire 2 for survey on carnivore presence.

#### 3.5. Structured Interview

To collect comprehensive information, personal interviews have been carried through leopard-human conflict areas and affected people followed by individual interviewee

whose livestock is affected due to leopard depredation from January 2014 to June 2016.

### 3.6. Group Discussion and In-depth Interview

Group discussion and in depth interview have been carried out with concerned people at village level and will be go on to other remaining areas. These discussions are useful to get general and historical information about the leopard predation on livestock in these target areas. The discussion and in-depth interview were based on semi-structured interview.

### 3.7. Collection of Secondary Data

The literature and information about leopard predation on livestock have been collected from stake holders like Forest Department of Assam, Assam State Zoo, discussions with the locals of the affected sites and villages (Village Heads), academician, wildlife experts, NGOs, Scientific papers, journals, Thesis and interim reports, newspapers, internet, libraries and other related repositories are also consulted.

## 4. Results

### 4.1. Camera Trap

The man-leopard conflict in Gaushala area is a long suffered problem in the locality. However, there was no scientific evidence collected for leopard behaviour and identification. For identification of leopard pocket, various caves were surveyed and nearest pugmark, carcass, scat, bone samples and regurgitate were observed, collected and photographed. During the survey, digital camera was used intensively to capture images of that crucial killing site whether inside home or outside in grazing area, and GPS parameters of the locations were recorded. For the first time camera trap is used to see the movement of leopards in the human habitats (Figure 2). The camera traps show that most of the views are found in the after 12 pm and around 3-4 am.

### 4.2. Field Observations

The methodology for field survey followed after [16] with slight modification to fit the local conditions. Scat sampling have been conducted across Gotanagar, Maligaon Gaushala, Dhopolia (Manpara) Jyotikuchi, Narakasur, Nilachal (Kamakhya Temple), Jalukbari, Lokhra, Maligaon West Boragaon, Sonaighuli,. From the observations in the field and surveys it has been observed that 61.76% of leopards were killed during conflict from 1993 to 2017 and 28.57% leopards were killed in the last three years. The known conflicts 29.41% have been translocated to the zoo for primary treatment and exhibition, this include 40% of that have been translocated to zoo in the last three years and 8.83% of leopards have been escaped in the wild during rescue operation. During 2015 -2017 32.35% of human leopard conflict have been reported. Out of the identified conflicts 28.57% have been killed in last three years.



Figure 2. Camera images of leopards in the study area



Figure 3. Wild caught in the study area

## 5. Discussion

The Gotanagar reserve forest which is an integral part of the Guwahati municipality region experiences rapid urbanisation in the last few decades. 171 hectare area undergone a rapid change specially in term of forest cover In 1988, moist mixed deciduous dense forest was 43 hectares which was reduced to 13 hectares while 1988 moist mixed deciduous open forest was reduced to 45 hectares from 65 hectares. There is a slight increase in scrubland where it is increased to 45 hectares from 32 hectares. Likewise the degraded forest have been increased to 65 hectares from 23 hectares. Water bodies have reduced by 3 hectares from 37 to 34 while there is an increase of 10 hectares in the non forest category.

These changes in forest cover not only reduced the habitat of leopards but also threatened the species by increasing the difficulty in preying. As result there are increase conflict in the vicinity of human habitat. Most interestingly casualties on the both sides are rising. This

study covers a small pocket of leopard habitation of the Guwahati city however robust estimate of leopard population size with thorough understanding of the driving factors of leopard-human conflict, through initiation of a multi-layer study on population monitoring, sample survey and Questionnaire techniques from the locals at the site of incidence, identification of leopards predatory behavior, patterns of livestock predation, prey selection and prey preferences, home range, farmers perception of leopards, feeding ecology through scat analysis, habitat utilization pattern and GIS based habitat change detection is utmost necessary to curve the growing conflict.

The present study, found 16 number of human-leopard conflicts i.e. 13 human casualties and 3 leopards mortality, and 29 incidence of livestock predation. It is also found that the area is used for feeding and breeding ground of cattle, for keeping invalid cows and dumping ground for dead cattle's carcass. Thick coverage of elephant grasses (*Pennisetum purpureum*) provides the foraging and hiding site for leopard. The expansion and increase encroachment to the habitat of leopard have been reason that caused 90 human-leopard conflicts since 1995. A thorough study on the population size of leopard is required to formulate proper conservational planning to mitigate the present situation

The method and techniques available for determining the presence and abundance of leopard species are varied. While, a combination of methods is always likely to provide the best result [17], the feasibility and application of appropriate methodology will always depend on factors such as the species, habitat, costs, manpower, time constraints [18], and also the kind of questions that are being addressed and the consequent accuracy and power of the statistical assumptions of each method [19].

The simultaneous application of different management practices and the implementation of those designed for local species are recommended. There is no single solution to the conflict and every preventative and mitigative strategy should be empirically tested for its cost effectiveness and possible impact on the ecosystem equilibrium before adoption. The best scenario would imply integrated community development and wildlife conservation promoted by national park managers and supported by local populations. Community-based conservation should give indigenous people the right to limited and sustainable use of natural resources while promoting tolerance towards wildlife, responsible interaction with their natural environment and recognize the value of natural heritage. Hans [20] proved that the rural villagers, who live in proximity to Waza National Park in Cameroon, appreciate nature's intrinsic value and agree with the necessity to protect forests and their wildlife inhabitants for future generations. Their positive attitude towards conservation arises from the use of natural resources such as regulated harvesting of non-timber forest products, the use of waterholes and fishing.

In order to enhance protected area effectiveness, conservation should be based on sound scientific knowledge, practical local indigenous knowledge and collaboration. Protected areas and the presence of wild animal populations inflict costs on local communities and can erode local support and tolerance. In turn, indigenous people can develop a negative attitude towards reserves

and wildlife, exacerbating the conflict and undermining conservation efforts. In order to break this cycle, there is a need to protect rural livelihoods, reduce their vulnerability, and counterbalance losses with benefits and foster community-based conservation. Both people and wildlife suffer tangible consequences and different stakeholders involved should commit themselves to tackle and resolve the conflict in the near future.

Due to lack of coordination and poor interpretation skills among the forest staffs, the existing wildlife, forest and environment laws are either not enforced or used properly to increase the rate of conviction to the poachers and smugglers involved in the illegal trade on wildlife contraband. There is a need to create a strong green bench in Assam for fast track solution of wildlife cases. Reports conducted on hunting reveals that illegal hunting and poaching is most widespread in landlocked North-east India, but we find that not much has been done to solve this problem. The driving forces of human-wildlife conflict such as human-population growth, climate change, increase in tourism etc must also be resolved through good strategies. While deciding matters related to wildlife tourism, it is important that they are in consonance with the long-term conservation interests of the protected area, habitat or species it relates to, and never the other way round. Again, though it is not feasible to relocate all the human settlements from the protected areas, certain settlements that are particularly problematic because they are in the middle of the protected areas or occupying some crucial habitat, could be motivated to move out voluntarily. They can be provided with lands away from the protected areas or they can be also given grants for building houses and all facilities that would be available under the National Policy on Resettlement and Rehabilitation, 2003. Another strategy that would greatly assist in reducing man-animal conflict is identification of crops, which could be planted around protected areas and elsewhere to reduce the quantum of crop-raiding by wild animals.

## 6. Conclusion

The rise of human-leopard conflict in and around the reserve forests of Maligaon Gaushala farmland, Guwahati, Assam, is due to the human expansion and encroachment to leopards' habitat. To reduce the present conflict level in both the respondents, it is required to conduct a thorough survey on the population structure and size of leopard, and to install alarming devices on the periphery of the designated site to monitor their movement.

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## Statement of Competing Interests

The researchers have no competing interest in this work.

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